(Model.)

2 Sheets—Sheet 1.

M. L. HARRIS.

PERMUTATION LOCK.

No. 370,056. Patented Sept. 20, 1887.

Fig. 1.

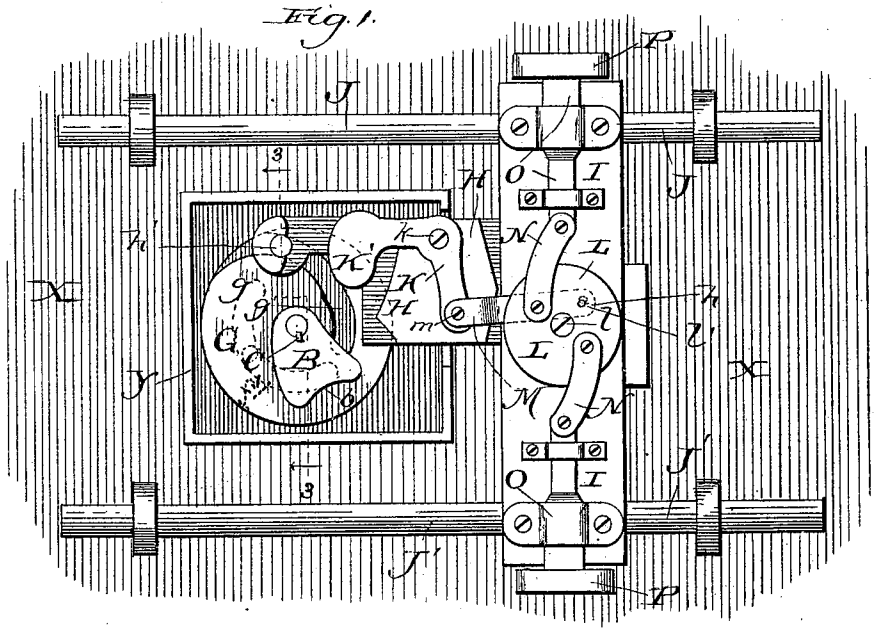
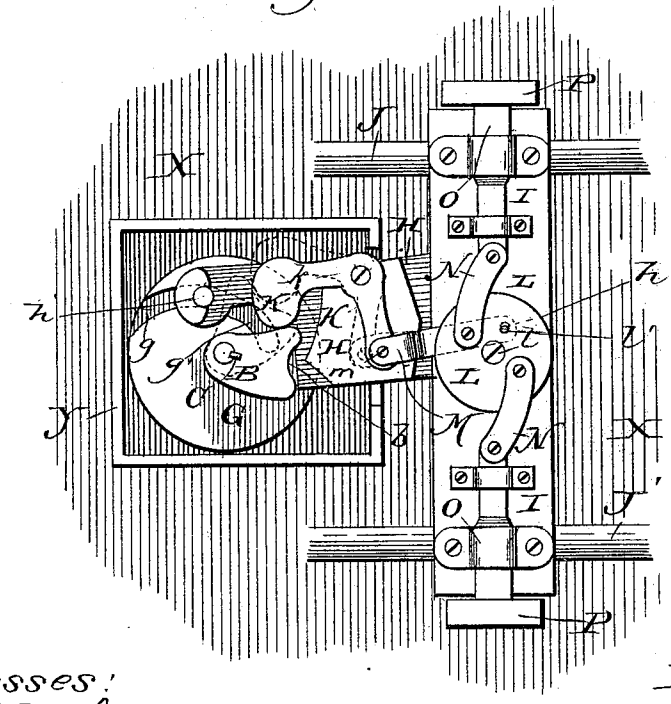


Fig. 2.



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(Model.) 2 Sheets—Sheet 2.

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Fig. 3.

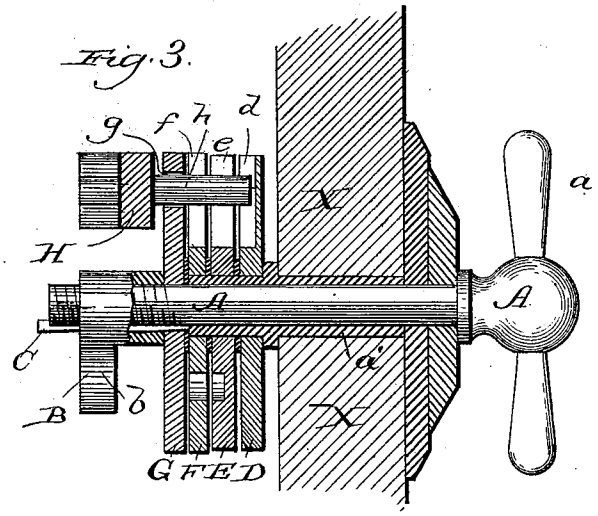


Fig. 4.

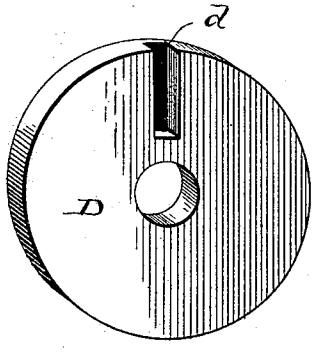
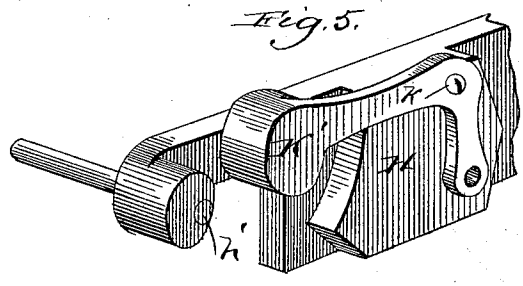


Fig. 5.



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UNITED STATES PATENT OFFICE.

MALCOLM L. HARRIS, OF CHICAGO, ILLINOIS.

PERMUTATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 370,056, dated September 20, 1887.

Application filed May 10, 1887. Serial No. 237,673. (Model.)

To all whom it may concern:

Be it known that I, MALCOLM L. HARRIS, a citizen of the United States, 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 description.

The object of my invention is to obtain a lock of the character named in which the handle turning into position the several slotted permutation-wheels commonly used in such locks may be and is utilized for turning back the bolts locking the door on which my improved lock is placed, dispensing with the handle heretofore attached directly to said bolts, and to construct a lock which shall lock said bolts in position when they are so placed as to lock the door, independent, to a certain extent, as is hereinafter more fully described, of the slotted permutation-wheels, the spindle, and the handle by which said wheels and spindle and said bolts locking the door are operated; and, further, to secure a lock which will present extremely difficult, if not insurmountable, obstacles to the unlocking thereof by any person or persons attempting to operate the said lock by other than the turning of the slotted permutation-wheels into proper position by the handle in the spindle on which are placed said wheels.

I have illustrated my invention by the drawings accompanying this specification and forming a part hereof, in which—

Figure 1 is a plan of the lock viewed from the back, with the back plate of the box inclosing the working parts of the lock removed, and illustrating the bolts locking the door thrown into a locked position and locked in such position by bolts, hereinafter fully described. Fig. 2 is a plan of the lock viewed as in Fig. 1, with the locking-bolts thrown into position to lock the door and there locked, the same as in Fig. 1, but with the several slotted permutation-wheels in such position that any further movement of the spindle on which said wheels are loosely placed (with a sleeve interposed between all but one of said wheels and said spindle) will unlock the bolts, so that they may be thrown back and the door unlocked. Fig. 3 is a cross-section on line 3 3 of Fig. 1. Fig. 4 is a plan of the slotted permutation-wheel coming nearest the door when placed on the spindle or sleeve surrounding the spindle. Fig. 5 is a perspective view of two levers used in my device, the smaller of said levers being pivoted on the larger one. One end of the larger lever rests upon the slotted permutation-wheels, the other end being pivoted to a cross-bar, hereinafter described, and when all of the said slots in such wheels are in line the end of said larger lever resting thereon is allowed to drop into the position illustrated in Fig. 2.

Like letters refer to like parts throughout the several views.

X is the door to which my lock is attached.

Y is the case inclosing the slotted permutation-wheels and a portion of the other working parts of the lock.

A is a spindle passing loosely through sleeve *a'*, secured to the door. One of the several slotted permutation-wheels and a cam are fastened to the spindle. The others of the slotted permutation-wheels turn loosely on the sleeve.

B is the cam, secured to the extreme inner end of spindle A by a screw-thread to prevent the spindle being pulled from said cam, and by a key, C, that they may turn in unison.

D is a permutation-wheel turning loosely on sleeve *a'*.

d is a slot or groove in wheel D. This slot or groove does not extend through the wheel D, a thin facing being left on the side of the said wheel D nearer the door.

E is a slotted permutation-wheel, also turning loosely on sleeve *a'*, and *e* is said slot in the wheel E.

F is a slotted permutation-wheel placed loosely on sleeve *a'*, having slot *f* therein. Each side of the several slots *d e f* is parallel to a radius of said wheels D E F, passing through the center of said slots, respectively.

G is a wheel secured to spindle A and rotating therewith. Wheel G has slot *g g'* therein. That portion of said slot lettered *g'* is the arc of a circle having a radius equal to the distance from the center of said wheel to the inner edge of said slot. The portion of the slot lettered *g* extends from one end of that part of the slot lettered *g'* to the periphery of said wheel G.

Permutation-wheels D E are of the same diameter. Wheels F and G are slightly larger

in diameter than are wheels D E, and are of equal diameter.

H is a lever pivoted on cross-bar I at point or pivot *h*. This cross-bar I connects bolts J J′, being secured to both of the said bolts. Longitudinal motion in bolts J J′ is obtained by the lateral movement of cross-bar I.

h′ is a pin or bolt in the free end of lever H, and this pin *h′* rests upon the periphery of the slotted permutation-wheels F and G in the ordinary manner when the door is locked and the several slotted permutation-wheels thrown into what may be termed a "locked position"—that is to say, when the several slots in said wheels are so scattered as not to allow the pin *h′* to enter into said slots—it being necessary, of course, that the slots in said wheels be all in line before the pin *h′* can enter any one of said slots. As the wheels F G, on which the pin *h′* rests, are slightly larger, as described, than are wheels D E, the weight of the free end of the lever H is not borne by either of said wheels D E, and therefore the position of the slots *d e* in wheels D E cannot be told or "felt" by the manipulation of handle on the spindle A.

Wheels D E are actuated in the ordinary manner of actuating permutation-wheels in locks of this character; but the pin moving wheel E is driven in wheel G and passes through slot *f′* in wheel F, extending beyond the face of said wheel F sufficiently to impinge against wheel E or a pin or groove therein. Slot *f′* is long enough to give a sufficient difference in the movement of wheels F and G, and may be made adjustable by constructing the wheel F so that the slot may be varied or changed in length, one end of said slot being thereby placed in different position on said wheel F relative to slot *f* therein. Slot *f′* is indicated by dotted lines on Fig. 1.

K is a secondary lever pivoted at point *k* on lever H. Lever K is slightly enlarged at the inner or free end, and may be made to partially rotate on pivot *k* by the action of cam B and the movement of lever H, as is hereinafter described.

L is a wheel forming a double right-angle lever, pivoted on cross-bar I and turning freely around pivot or center *l*.

l′ is a pin on wheel L, placed in such position that when the bolts J J′ are locked by means of the bolts on said cross-bar I, hereinafter described, into a position locking the door, the said pin *l′* is over, or nearly so, pivot *h* on said cross-bar. Pin *l′*, last described, is a pivot on which is placed connecting-rod M, pivoted at its other end on pin *m* in secondary lever K.

N N are connecting-rods, secured at one end to wheel L and at the other end to bolts O O.

P P are cleats fastened to door X, having holes or mortises therein, into which bolts O O are pushed, thus locking cross-bar I from lateral movement.

Pivots *h* and *l′* being over each other, or nearly so, when the bolts J J′ are thrown into position locking the door, and locked in such position by bolts O O in cleats P P, any movement of levers H and K thereon around pivots *h l′* will not change the relative position of said levers K and H.

The method of operation of my improved permutation-lock is: The door to which the lock is attached is locked by throwing the bolts J J′ into the position indicated in Fig. 1, and said bolts J J′ are locked in such position by bolts O O on cross-bar I being thrown into holes or mortises in cleats P P. Cleats P P are secured to door X. By getting the several slots in permutation-wheels D E F into line by the alternate right and left movement of spindle A in the ordinary way, wheel G, secured to spindle A, may then be turned to the left, as viewed in Figs. 1 and 2, and lever H, or the free end thereof, in which is placed pin *h′*, will drop into the slots *d e f* on said wheels D E F, and as said pin *h′* drops into said slots it is grasped by slot *g g′* on wheel G and locked in such position. This slot *g g′* also prevents the pin *h′* from dropping suddenly, it being allowed to drop only so fast as wheel G is turned. When this wheel G has been turned so that pin *h′* is in the portion of the slot *g g′* lettered *g′*, or just entering that part of the slot, any further rotation of said wheel will cause no movement in pin *h′*. This position of wheel G and lever H K, pin *h′* on lever H, and head K′ on lever K is illustrated by Fig. 2, and at this time the upper face of the cam B comes in contact with the lower surface of said head K′ of secondary lever K, and further rotation of wheel G, spindle A, and cam B will turn said lever K on pivot *k* into the position indicated by the dotted lines outlining said lever K in Fig. 2. A partial revolution of wheel L is thus produced, and bolts O O are withdrawn from cleats P P. A lateral movement may be given cross-bar I, and a longitudinal motion thus imparted bolts J J′. This longitudinal movement in bolts J J′ is obtained by the forward face of cam B coming in contact with pin *h′* in the further forward motion of wheel G. The face *b* of cam B is of such shape that as levers H K are moved longitudinally, or nearly so, by said cam B the relative position of said levers remains unchanged. The door is thus unlocked. To lock the door it is only necessary to throw spindle A and cam B, secured thereon, to the right, as viewed in Figs. 1 and 2, when the bolts J J′ are first thrown into a position locking the door by the then forward face of said cam B coming in contact with face *b′* of lever H. After the bolts J J′ are thus thrown into position the further turning of the spindle A and cam B will raise that end of lever H in which is placed pin *h′* into the position indicated in Fig. 1. As the inner or free end of lever H is raised by pin *h′* in slot *g g′*, as last above described, the upper face of the secondary lever K is brought in contact with the inner upper face of box Y inclosing the same. A partial rotary movement of said lever K is thus imparted it on pivot *k*, a rotary motion given

wheel L, and the bolts O O thrown into cleats P P.

It is evident that no longitudinal movement can be imparted to bolts J J′ so long as the bolts O O are in cleats P P, and it is also evident that the destruction of the slotted permutation-wheels and cam B, as by the withdrawal of spindle A from the door, would in no way tend to release said bolts O O from said cleats P P, and therefore said spindle A may be withdrawn without placing the locks so that bolts J J′ may be turned back and the door unlocked. Moreover, the spindle A being withdrawn, all means for withdrawing said bolts J J′ are gone, as are also all means of withdrawing bolts O O, locking said bolts J J′ in position. The peculiar movement required in head K′ of lever K as compared with the movement of pin *h*′ on lever H is such that upon the withdrawal of said spindle A from the several slotted permutation-wheels and the cam it will be extremely difficult, if not impossible, to withdraw bolts O O from cleats P P sufficiently to unlock them therefrom.

Having thus described my invention and its method of operation, what I claim, and desire to secure by Letters Patent, is—

1. In a permutation-lock, a spindle with a handle thereon, said spindle passing loosely through a sleeve, a cam, and a permutation-wheel secured to said spindle, said wheel having a slot therein extending from the periphery thereof around and toward its center, in combination with a lever resting at one end on said permutation-wheel and actuated by said wheel and cam, and pivoted at the other end on a cross-bar connecting bolts moving longitudinally in standards secured to the door to which the lock is attached, all substantially as described.

2. In a permutation-lock, a spindle passing through a sleeve, slotted permutation-wheels turning loosely on said sleeve, and a slotted permutation-wheel and a cam secured to said spindle, in combination with a lever attached to a cross-bar connecting bolts having a longitudinal movement in standards secured to the door on which the lock is placed, the free end of said lever resting on said permutation-wheels or one or more of said wheels, a second lever pivoted on said first-named lever, one end of said second lever actuating bolts on said cross-bar and the other end of said second lever, together with the free end of said first-named lever, actuated by the cam and wheel secured to said spindle, all substantially as described.

3. In a permutation-lock, a spindle passing loosely through a sleeve, slotted permutation-wheels turning loosely on said sleeve, said spindle having secured at one end thereof a handle by which it may be turned, a permutation-wheel secured to the other end thereof and having a slot therein extending from the periphery thereof around and toward its center, and a cam, also secured to said spindle, in combination with a lever actuated by said cam and slotted permutation-wheel secured to said spindle, one end of said lever being pivoted on a cross-bar having a lateral motion and actuating bolts moving longitudinally in standards secured to the door to which the lock is attached, all substantially as described.

4. In a permutation-lock, a spindle passing loosely through a sleeve, slotted permutation-wheels turning loosely on said sleeve, a permutation-wheel secured to the spindle, a cam, also secured to the spindle, one or more of said slotted permutation-wheels being larger than the other or others thereof, in combination with a lever pivoted at one end to a cross-bar connecting bolts locking the door to which the lock is attached, and said lever resting at the other end on the larger of said slotted wheels by a pin, which pin is fitted to drop into the several slots in all of said wheels when said slots are brought into position, all substantially as described, and for the purpose set forth.

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