T. FOX.

PERMUTATION-LOCK.

No. 193,500. Patented July 24, 1877.

Fig. 1

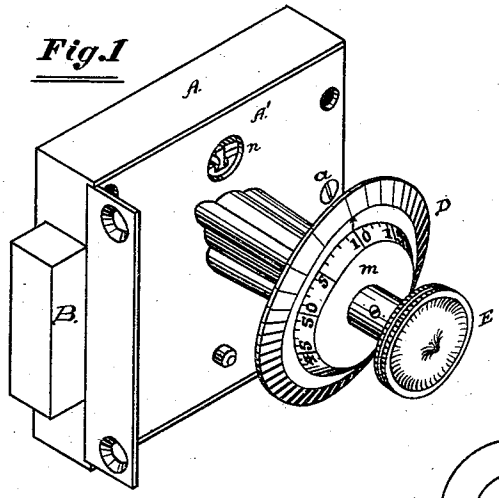


Fig. 4

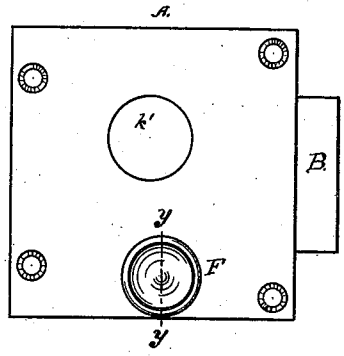


Fig. 5

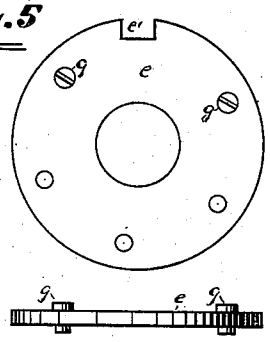


Fig. 7

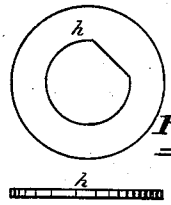


Fig. 8

Fig. 6

Fig. 2

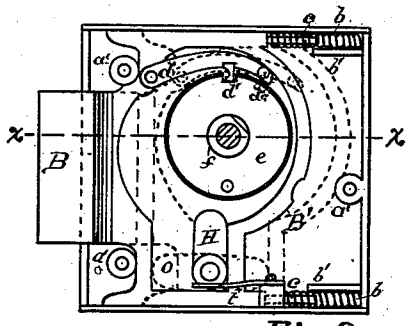


Fig. 9

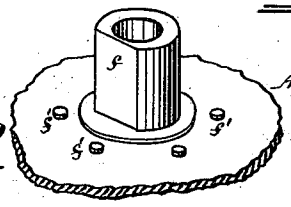


Fig. 3

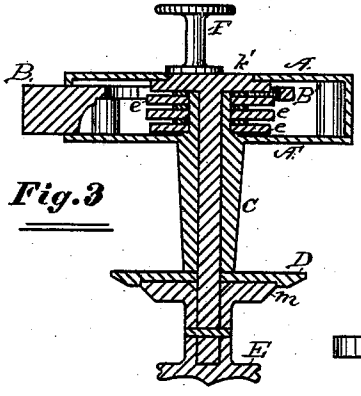


Fig. 10

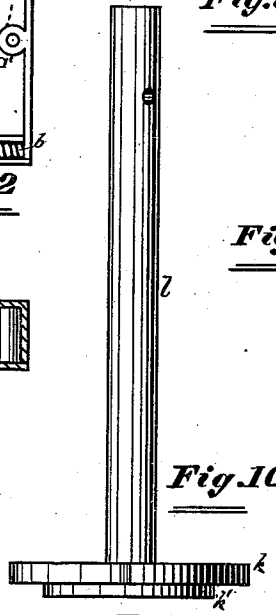


Fig. 12

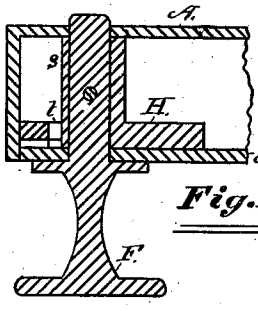
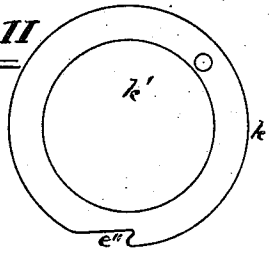


Fig. 11



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UNITED STATES PATENT OFFICE.

THOMAS FOX, OF BAY CITY, MICHIGAN, ASSIGNOR TO HIMSELF AND JAMES J. FITZGERRELL, OF SAME PLACE.

IMPROVEMENT IN PERMUTATION-LOCKS.

Specification forming part of Letters Patent No. **193,500**, dated July 24, 1877; application filed May 25, 1877.

To all whom it may concern:

Be it known that I, THOMAS FOX, of Bay City, in the county of Bay and State of Michigan, have invented certain new and useful Improvements in Permutation Door-Locks; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My improvement relates to that class of locks known as door-locks, and is especially designed for bank, store, or other outside doors requiring a strong and safe lock that shall be proof against the machinations of thieves; and the invention consists in the construction and arrangement of the bolt-frame fitting loosely within the lock-case; and, further, in the especial construction and combination, with other parts of the lock, of the various parts, as will be hereinafter fully described, and then specifically pointed out in the claims.

In the drawings, Figure 1 is a perspective view of the lock complete. Fig. 2 shows the interior of the case, the back plate having been removed. Fig. 3 is a vertical section through the lock on the line *x x* of Fig. 2. Fig. 4 represents a rear view of the lock-case. Figs. 5 and 6 are a side and edge view of one of the rotating tumblers. Figs. 7 and 8 show the washers that are to be placed between the rotary tumblers. Fig. 9 is an enlarged view of the sleeve attached to the inner face of the front plate of the case upon which the tumblers and their separating-washers are placed. Fig. 10 is an enlarged view of the spindle, through which the movements of the knob are communicated to the interior mechanism of the lock. Fig. 11 is a side view of the hook-ring attached to the inner end of the spindle, by which the bolt is drawn back. Fig. 12 represents the cam and its operating-knob, by means of which the bolt is thrown out or withdrawn from the inside of the door.

The lock-case is composed of two parts, an outer case, A, cast in one piece with the sides, and an inner plate or cover, A′, which rests against the inside of the door to which the lock is attached, and has cast with or securely attached to it the sleeve, C, which passes through the door, and carries upon its outer end the escutcheon D. The two parts A and A′ are secured to each other by screws *a*, which pass through the part A′, and are screwed into the studs *a′*, which project from the part A, of which they are an integral part, being cast with it.

The bolt B is attached to or cast with the bolt-frame B′, the construction of which is such that it fits loosely in the lock-case, the inner end having two projections, *b b*, which, when the bolt recedes, strike against the back of the lock-case. Surrounding these projections are the spiral springs *c c*, retained in their proper position by housings *b′ b′*, consisting of projections cast on the case, and having a length equal to that of the springs, and the proper distance from the sides of the lock-case, while a projection cast upon the inner side of that part of the plate or cover marked A′ comes down over the springs to complete the housing and retain the springs and the inclosed cylindrical projections *b* in position. As one end of the springs *c c* bears against the lock-case and the other against the bolt-frame, it is evident their force will be expended in throwing forward the bolt whenever it is released from the withdrawing mechanism.

The bolt-frame B′ encircles the operating mechanism within the lock-case, and is held in place by the ways upon the sides of the case and the bearings of the bolt in front.

Attached to the bolt-frame by a pivot is a pawl, *d*. This pawl swings freely in a vertical direction, and carries the dog *d′*, one end of which passes beneath the bolt-frame, and is thus prevented from being thrown too high by the action upon it of the rotating tumblers *e*. The pin *d″* near the end of the pawl is of such length as to just clear the inner surface of the case, and steadies the pawl, so that the lower face of the dog *d′* rides steadily upon the peripheries of the rotating tumblers *e*, and moving easily upon them is ready to drop into the notches *e′* whenever, by their rotation, the notches are brought in line with each other. On the inside of the cover A′ is cast a sleeve, *f*. One

side of this sleeve, after its surface has been trued to fit the openings in the tumbler, is flattened, and on it is first placed one of the rotary tumblers *e*. In order to relieve the first tumbler from excessive friction against the cover A′ and cause it to revolve in a true plane, a series of projections, *f′*, are cast upon the lock plate or cover A′ in a circular form, and make the resisting-surface against which the side of the rotating tumbler impinges. In each tumbler there is formed a circular series of holes suitable for receiving the screw-pins *g*, which project sufficiently to catch similar screw-pins inserted in the other adjacent tumblers. There may be one or two of these screw-pins used in each tumbler placed opposite each other or on quarters of the circle formed by the series of holes into which they are inserted. I next place on the sleeve *f* a washer, *h*, that is so constructed as to fit the flatted sleeve and prevent its being turned by friction against the rotary tumblers. Next, I place upon the sleeve another rotary tumbler with screw-pins projecting each way from the sides of the tumbler, and arranged to change from one hole to another, as already described in the first rotary tumbler. Then another washer is placed upon the sleeve, and an additional tumbler, as before described, and so on until as many tumblers are placed upon the sleeve as may be required to fill it to the end, leaving room for a washer outside of the last tumbler. In order to retain the tumblers and washers upon the sleeve a driving-ring, *k*, is cast or otherwise secured upon one end of the spindle *l*, (which will be further described hereinafter.) This driving-ring has a projection, *k′*, which extends through an orifice in the outer case A, and when in place forms a portion of the case as well as a bearing for the outer end of the spindle. The driving-ring *k* should have the same diameter as the tumblers; but the screw-pins inserted in it, and by which it imparts motion to the tumblers should only project inward, and be arranged as described for the first tumbler. In the periphery of this driving-ring a notch, *e″*, is formed, one side of which is nearly on a radial line, and of a depth equal to those in the wards, the opposite side of the notch being so slanted as to lift the dog out of the notches in the wards when it is turned in one direction, and to draw back the bolt when turned in the opposite direction.

The spindle *l*, which carries the driving-ring, is passed through the sleeve *f*, heretofore described also through the spindle holder or sleeve C, and escutcheon D then into the shank of the operating-knob E, where it is secured by a screw or other suitable device; but I prefer to use a screw running through the knob, shank, and spindle.

The spindle-sleeve C is made of such length that it may be cut off to suit the thickness of any door, and is provided with ribs upon its outer surface, which receive the screws by which the escutcheon is secured in place. I prefer to use a round escutcheon with an index-mark stamped upon it, to indicate the combination, and to present a finished appearance on the outside of the door.

A recess is made in the face of the escutcheon to receive the periphery of the knob-flange *m*, on which are placed radial marks and numbers running from one upward, and filling the circle, to indicate the numbers of the combination.

In the cover A′ may be made a hole, *n*, just opposite the periphery of the rotary tumblers, through which their position may be observed.

Attached to the stem of the knob F, which projects from the lock upon the inside of the door, is a cam-lever, H, working in a recess, *o*, formed in the lower side of the bolt-frame. The lower side of this cam-lever at *s* is flattened, so that when it is placed in an upright position it will be retained in that position by the spring *t*, which is attached to the bottom of the lock-case. This cam-lever is of such length that by taking hold of the knob F and turning it against the spring in one direction, the bolt-frame will be thrown back independent of the knob E, thus drawing the bolt B within the lock-case, and dead-locking it in that position.

By turning the knob F back until the cam-lever is in an upright position, the bolt-frame will be released, and may be operated by the outside knob E; then, by rotating the cam-lever still farther forward, it will lie in a horizontal position within the recess *o*, its end bearing against the bolt-frame, and hold the bolt B dead-locked forward. When in this position the knob E and rotary wards will be worked to no purpose, as the cam-lever holds the bolt entirely independent of the outside knob which operates the combination.

The method of operating the combination part of the lock when it is in place on a door is as follows: By turning the knob E four or more times to the left, until all the tumblers are rotating in one direction, the position of the first tumbler will be taken by the number on the flange *m* coming opposite the index-mark upon the escutcheon. This will bring the notch in the tumbler under the dog *d′*; then, by reversing the rotation of the knob E, the screw-pins in the tumblers will engage with each other, and bring the second tumbler into the same position as the first, with relation to the dog, which will be indicated by the figures and marks upon the flange and escutcheon coming in juxtaposition. The motion of the knob E is then reversed, it being again turned to the left, and the operation heretofore described repeated until all the tumblers are in such a position that the dog will fall into their notches, as well as into the notch in the driving-ring, when a further rotation of the knob E in the proper direction will force the bolt-frame and bolt back against the springs *c*, thus allowing the door to be unlocked from the outside.

I am aware that many parts of this lock are old, and have been in common use for a long time. I therefore wish to be understood as making no claim to such parts; but

What I do claim as of my invention, and desire to secure by Letters Patent, is as follows:

The plate A′, provided with the sleeve C upon one side, and the flatted sleeve *f* on the other, and having the series of projections *f′* cast thereon, as and for the purpose described.

In testimony whereof I have hereunto affixed my signature this 13th day of November 1876, in presence of two witnesses.

THOMAS FOX.

Witnesses:

JAMES J. FITZGERRELL,

E. E. BRIGGS.