(Model.)

2 Sheets—Sheet 1.

E. C. SMITH.

LOCK.

No. 418,476. Patented Dec. 31, 1889.

Fig. 1.

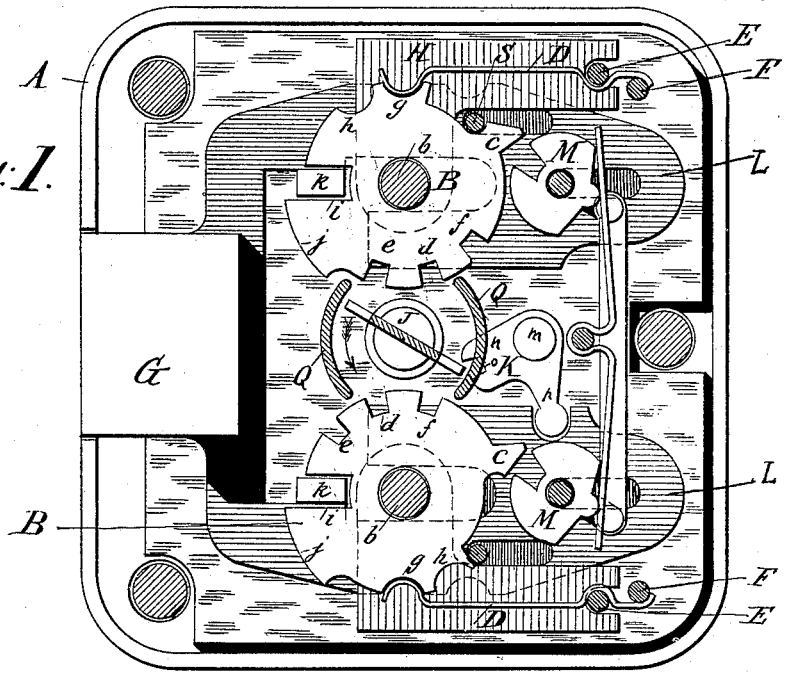
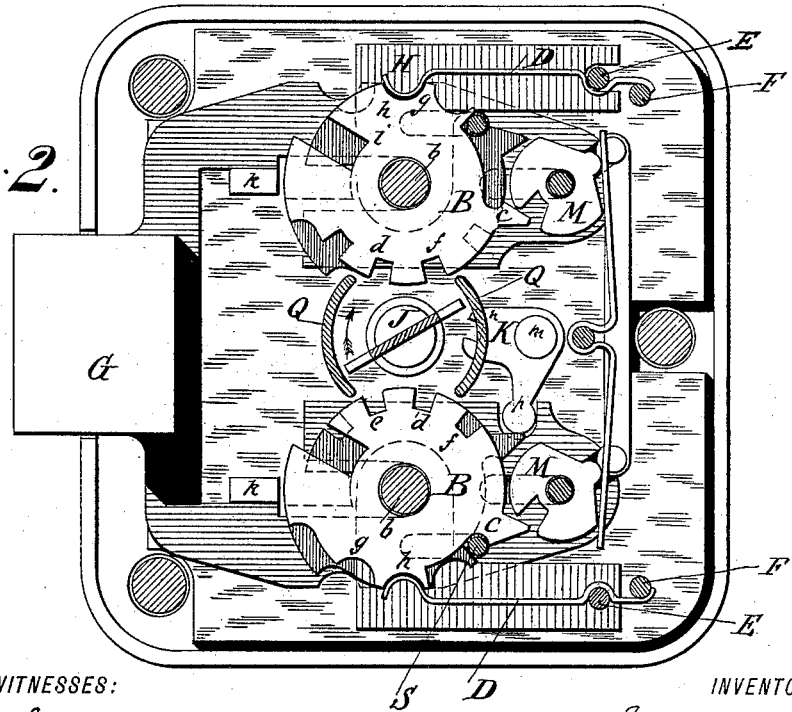


Fig. 2.



WITNESSES:

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INVENTOR

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ATTORNEY

(Model.) 2 Sheets—Sheet 2.

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Fig. 3

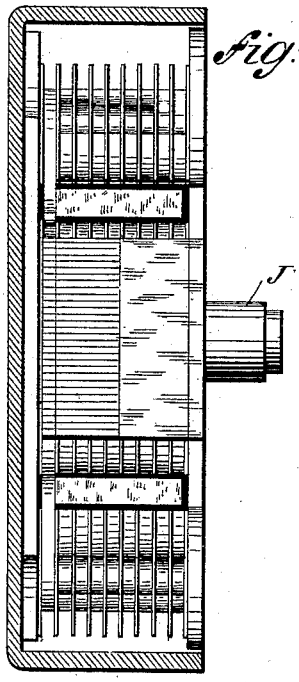


Fig. 4.

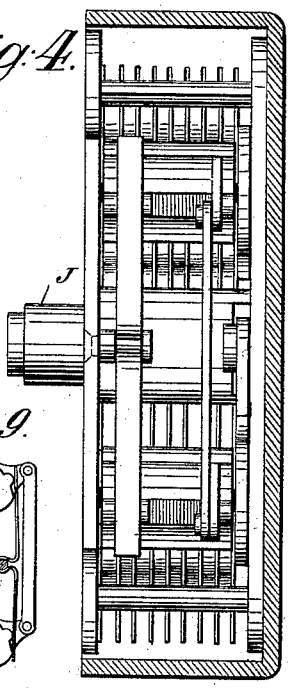


Fig. 5.

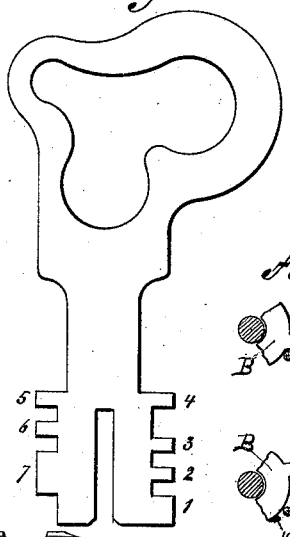


Fig. 9.

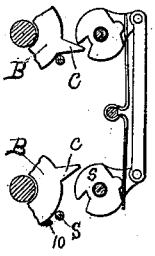


Fig. 6.

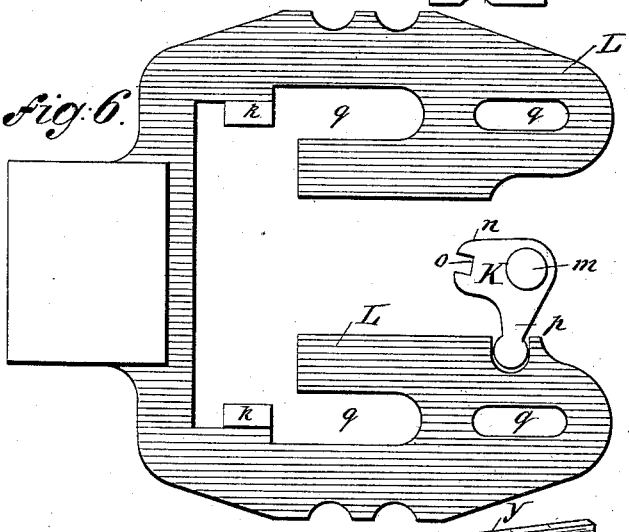


Fig. 7.

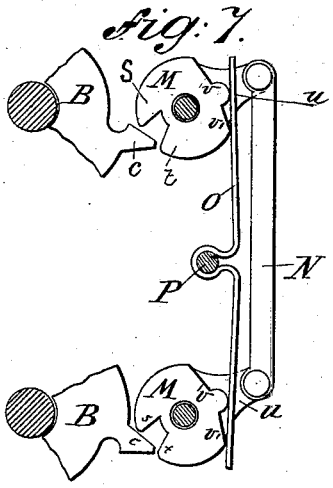
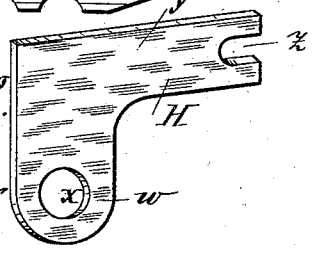


Fig. 8.



WITNESSES:

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INVENTOR

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BY

D. Walter Brown

ATTORNEY

UNITED STATES PATENT OFFICE.

EUGENE C. SMITH, OF NEW YORK, N. Y., ASSIGNOR TO THE UNIVERSAL LOCK COMPANY OF NEW YORK, OF SAME PLACE.

LOCK.

SPECIFICATION forming part of Letters Patent No. 418,476, dated December 31, 1889.

Application filed February 8, 1889. Serial No. 299,116. (Model.)

To all whom it may concern:

Be it known that I, EUGENE C. SMITH, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Combination-Locks, of which the following is a specification.

My invention relates to improvements in the combination-lock shown in my application filed in the United States Patent Office November 14, 1888, Serial No. 290,804, and the purpose of the improvement is to produce a lock of great compactness, cheapness, and range of combinations for special uses.

My invention also relates to the particular means by which these objects are attained.

The locks described in my application hereinbefore referred to admit of the use of any number of tumblers; but, since the tumblers therein all revolve on the same axis or shift on the same pins, any increase in the number of tumblers must be attended with an increase in the thickness of the lock. This increase of thickness is often very undesirable, since thin locks can be used advantageously for many purposes—as for drawer and box locks—where the employment of thick locks would be objectionable and expensive. On the other hand, a considerable number of tumblers in a lock is very advantageous, because the number of possible combinations increases in a very rapid ratio with a slight increase in the number of tumblers, as follows from well-understood mathematical principles.

My present improvement provides a lock which is at once thin, compact, and capable of a very great number of combinations.

Referring to the drawings which accompany the specification, Figure 1 is a plan or front view of the lock with the front plates removed to show the mechanism in unlocked position. Fig. 2 is a plan view similar to Fig. 1, except that certain of the tumblers and the bolt are shown in locked position. Fig. 3 is an elevation of the mechanism from the bolt side. Fig. 4 is an elevation of the mechanism from the locking-bar side. Fig. 5 is a view of a double-bitted key. Fig. 6 is a plan of the bolt, stumps, slides, and bell-crank lever for shooting the bolt. Fig. 7 is a side elevation of the locking-bars, connecting-rod, and tops of two tumblers in locked position. Fig. 8 is a plan of a washer which is inserted between the tumblers. Fig. 9 is a side elevation of the locking-bars, connecting-rod, and tops of two tumblers to show their position when locked with a single-bitted key.

The lock has shifting tumblers locked by a locking-bar, which is engaged by cams or projection on the tumblers, as described in my application hereinbefore referred to. The tumblers are arranged in two sets, rotating upon two centrally-placed axes, which are fixed in the case. On each tumbler is a cam, so placed that all the cams of each set of tumblers are in a right line when the tumblers are all in locked or unlocked position, and engaging with these cams is a locking-bar for each set of tumblers. The tumblers have true key-slots to engage with the bits of a key, which turns in a centrally-slotted axially-rotating key-cylinder, and also false key-slots, so placed that the false slots of locked tumblers will form a right line with the true slots of unlocked tumblers, and no indication will be given of what tumblers have been moved. One nib of the key engages with a bell-crank lever which throws the bolt. The tumblers, locking-bars, and bolts have springs to retain them in their several positions.

The locks are adapted to any use where my lock described in the application hereinbefore referred to can be used, but they are particularly advantageous where thin locks are desired.

In the description of the lock, A is the case with the front plates removed to show the mechanism. The said case may be constructed and closed in any well-known manner.

B B are tumblers arranged in two sets and rotating on centrally-placed axes *b b*, fixed in the lock-case, and preferably perpendicular to the back plate of the case. All the said tumblers B are of the same size and shape, preferably approximating the circular form, as shown, and each tumbler B has a projection or cam *c* and also a true key-slot *d*, to engage with a bit of a key, and false

slots *e f* to each side of the true slots. The said several slots are so placed that the true and false slots of the locked tumblers will form right lines with the false and true slots of the unlocked tumblers, respectively, and there will be no indication to a pick or waxed blank of what tumblers are in locked position. Each tumbler also has recesses *g h* to receive the ends of springs D, which are fixed at their other extremity to pins E F. The said springs may be formed of wires or stamped from a single sheet of metal. In each tumbler and opposite to the cams *c* are bolt-slots *i*, placed to form a straight line across the edge of the tumblers when in neutral position and admit of the stumps K of the bolt being drawn back into them, as in Fig. 1. Adjoining the slots *i* are raised or cam portions *j* of the tumblers B, so placed with reference to the rotation of the tumblers B that when the bolt G is shot and certain of the tumblers are turned to the locked position the cams *j* of such tumblers will pass behind the bolt-stumps *k* and prevent the withdrawal of the bolt, as shown in Fig. 2. Between the tumblers B are washers H, which serve also as guides for the springs D, as hereinafter explained.

Between the two sets of tumblers B is the key-cylinder J, revolving in the case on a centrally-located axial pin, and having its center of rotation in the right line joining the centers of rotation of the two sets of tumblers B, as is clearly shown in the drawings. I regard this rectilinear position of the three axes highly important to secure the proper engaging of a two-bitted key with both sets of tumblers. The said key-cylinder J is slotted longitudinally to guide the key, and there is the usual key-slot in the lock-case.

Adjoining the key-cylinder J is a bell-crank lever K, rotating on an axis *m*, and having an arm *n*, with slot *o*, to engage with a bit of the key, and another arm *p*, engaging with a slot in the slide L of the bolt G. The said slide L is formed with two arms, as shown in Fig. 6, each arm having slots *g g* to admit of the slides L passing the axes *b* and the pins S. The slots *g* and axes *b* serve as guides to the bolt G. The slides are recessed to receive the end of a bolt-spring, as shown in Fig. 6.

Arranged at a position suitable to engage with the tumbler-cams *c* are two locking-bars M, rotating on axes *r*, fixed in the case and parallel to the axes *b* of the tumblers B. The locking-bars are straight longitudinally and in cross-section, being substantially bent levers having arms *s t*, the space between said arms being formed to permit of the rotation of the cams *c*, after the manner of geared wheels.

On the back of the locking-bars M are arms *u*, to receive the ends of a connecting-rod N, which is movably secured to the arms *u* by pins or rivets. The purpose of the said connecting-rod N is to impart simultaneous and similar motion to both locking-bars. The said locking-bars are retained in their several positions by springs O, which are fixed at their center to a pin P, and have their free ends bearing on flat sides V V of the said locking-bars M in their several positions, as shown in Figs. 1 and 2.

Around the key-cylinder J is a shield Q, fixed in the lock-case and preferably formed for cheapness as circular segments, as shown. These shields prevent a pick from reaching the locking-bars. The segment of the shield toward the bell-crank lever K is slotted to permit of the motion of said lever.

The hereinbefore-mentioned washers H are formed of non-corrosive metal, with one arm W, having an opening X, to fit the axes *b* of the tumblers B, and another arm *y*, which reaches up between each pair of springs D, as seen in Fig. 1, the said arm *y* extending somewhat above and below the springs. In the arm *y* is a slot *z* to engage upon the pins D E. The washers form guides for the springs D, and serve to hold each spring accurately upon its proper tumbler and upon the bolt-slide. The washers are clearly shown between the tumblers and springs in Figs. 3 and 4.

S, Figs. 1 and 2, is a fixed pin serving to limit the motion of the tumblers B by bearing against shoulders or cams on the said tumblers, as shown.

Operation of the lock.—Suppose the mechanism in the unlocked position of Fig. 1, and a double-bitted key, as Fig. 5, inserted and turned in the direction of the arrow to lock the lock. The bit 1 first engages the slot *o* in the crank K and shoots the bolt G. Then, continuing its revolution, the bits 2 3 4 5 6 7 engage key-slots in corresponding tumblers B of each set of tumblers, rotating said tumblers in a direction opposite to the revolution of the key and bringing the cams *j* behind the stumps *k*, so that the bolt G cannot be drawn back. In the aforesaid rotation of the tumblers the cams *c* press upon the arms *t* of the locking-bars M, causing said locking-bars to take the position shown in Figs. 2 and 7. The aforesaid pins S act as stops to prevent the tumblers B from accidentally turning too far. The bits of the key are now free of the slots in the tumblers B and the key may be turned until it can be withdrawn from the lock. To unlock the lock, the same key as is employed to lock it is used, being turned in the reverse direction. Its bits first engage the key-slots of the locked tumblers, rotating the tumblers in a direction reverse to the motion of locking. The cams *c* press simultaneously on the arms *s* of the locking-bars, turning said locking-bars to the position of Fig. 1. The revolution of the tumblers also brings the slots *e* behind the stumps *k*, and the bits of the key now come free of the slots in the tumblers B. The key continuing its motion, the bit 1 engages the lever K in a direction reverse to locking and draws back the bolt, the stumps *k* withdrawing into the slot *i*. The key continues its motion until it can be withdrawn.

From the foregoing description it will be seen that a key having bits on only one side can be used. Such a key would have its plain side sufficiently narrow to pass by the tumblers on that side without touching them, and would have its bits corresponding to some certain combination of tumblers. The form of a single-bitted key being self-evident, such key is not shown in the drawings. It will operate as follows: Its bolt-bit will actuate the bell-crank lever K and shoot the bolt. Then, the revolution of the key continuing, its plain side will pass the corresponding set of tumblers without communicating motion to any of them, and the bits of said key will actuate corresponding tumblers and move them into the locked position, so that their cams *j* will prevent the withdrawal of the bolt. The cams *c* of the locking-tumblers will rotate their corresponding locking-bar M, and the connecting-rod N will impart similar motion to the other locking-bar, whereby its arm *s* will be brought adjacent to the cams *c* of the unlocked tumblers and in the position shown to the right in Fig. 9. The neutral tumblers are now held immovable by reason of the aforesaid arm *s* of the locking-bar, the pin S, and the cams *c* and shoulder 10 of the said neutral or unlocked tumblers. The key continues its turning till it can be withdrawn.

The operation of unlocking by a single-bitted key is simply the reverse of locking.

The locking-bar M secures the lock against picking in the following manner: The locked tumblers have the side of their cams *c* just in contact with the arm *s* of the locking-bar M and the top of the cams just clearing the arm *t* of said locking-bar. Now, should a pick feel one of the locked tumblers and attempt to turn it to the unlocked position, the cam of such tumbler, pressing against the arm *s* of the locking-bar, will slightly rotate said locking-bar, whereby the arm *t* will be brought hard down upon the tops of the cams of the other locked tumblers and will prevent any of said tumblers from passing the locking-bar and reaching the neutral position. It is necessary that every one of the locked tumblers shall be moved simultaneously, in order to cause the locking-bar to freely rotate and free the cams, which cannot be done by a pick, and also it will be apparent can only be done by a key having bits exactly corresponding with the bits of the key which locked the lock.

I claim—

1. In a tumbler-lock, two axially-rotating locking-bars adapted to engage with shiftable tumblers, the said locking-bars being movably connected together by a connecting-rod, so that both locking-bars have similar and simultaneous motion, as herein described.

2. In a combination-lock, two sets of axially-rotating tumblers having cam projections, two axially-rotating locking-bars having arms engaging with the aforesaid cam projections of each set of tumblers severally, and a connecting-rod movably connecting the said locking-bars, as described.

3. In a combination-lock, the combination of an axially-rotating key-cylinder, a key, a bolt, and a lever having an arm adapted to be engaged by the key, and another arm adapted to engage with the bolt, as herein described.

4. In a tumbler-lock, and in combination with the tumblers and tumbler-springs, a washer inserted between the said tumblers and springs, as herein described.

5. In a tumbler-lock, the combination of two sets of axially-rotating tumblers and an axially-rotating key-cylinder, the said key-cylinder having the center of its axis in the right line joining the center of the axes of the two sets of tumblers, as herein described.

6. The combination, in a tumbler-lock, of two sets of axially-rotating tumblers having cam projections, two axially-rotating locking-bars having arms engaging the said cam projections of each set of tumblers severally, a connecting-rod movably connecting the said locking-bars, an axially-rotating key-cylinder midway between the aforesaid two sets of tumblers and having the center of its axis in the right line joining the center of the axes of the two sets of tumblers, and a lever having an arm adapted to be engaged by a key, and an arm adapted to engage with a bolt, as herein described.

In witness whereof I have hereunto set my hand this 7th day of February, 1889.

EUGENE C. SMITH.

Witnesses:
G. A. SCHELLENGER,
M. F. DUFLOCQ.