(Model.) 3 Sheets—Sheet 1.

E. C. SMITH.

CYLINDER LOCK.

No. 457,873. Patented Aug. 18, 1891.

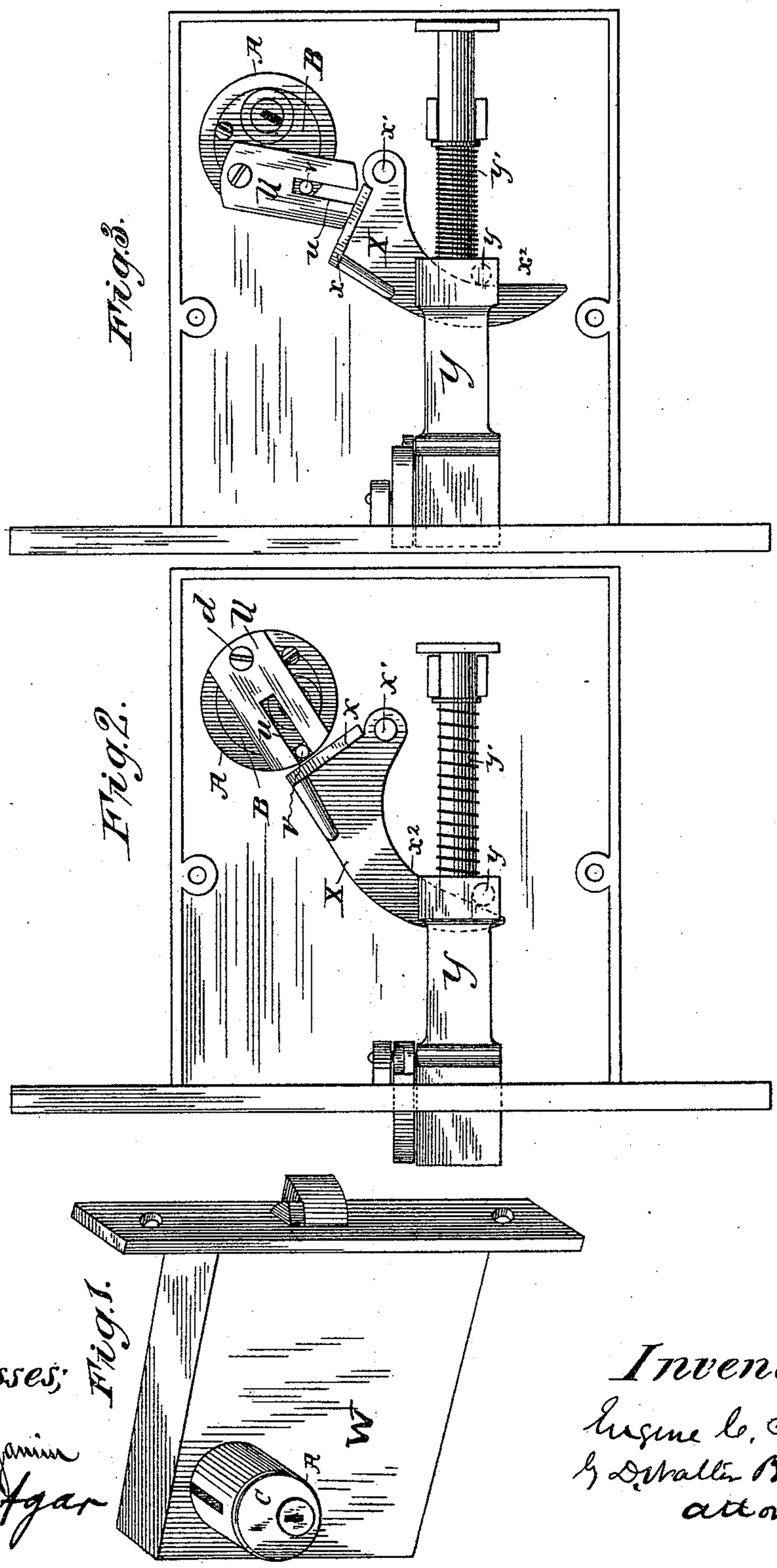

Fig. 1. Fig. 2.

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Inventor;
Eugene C. Smith,
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attorney

(Model.)

3 Sheets—Sheet 2.

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Fig. 4.

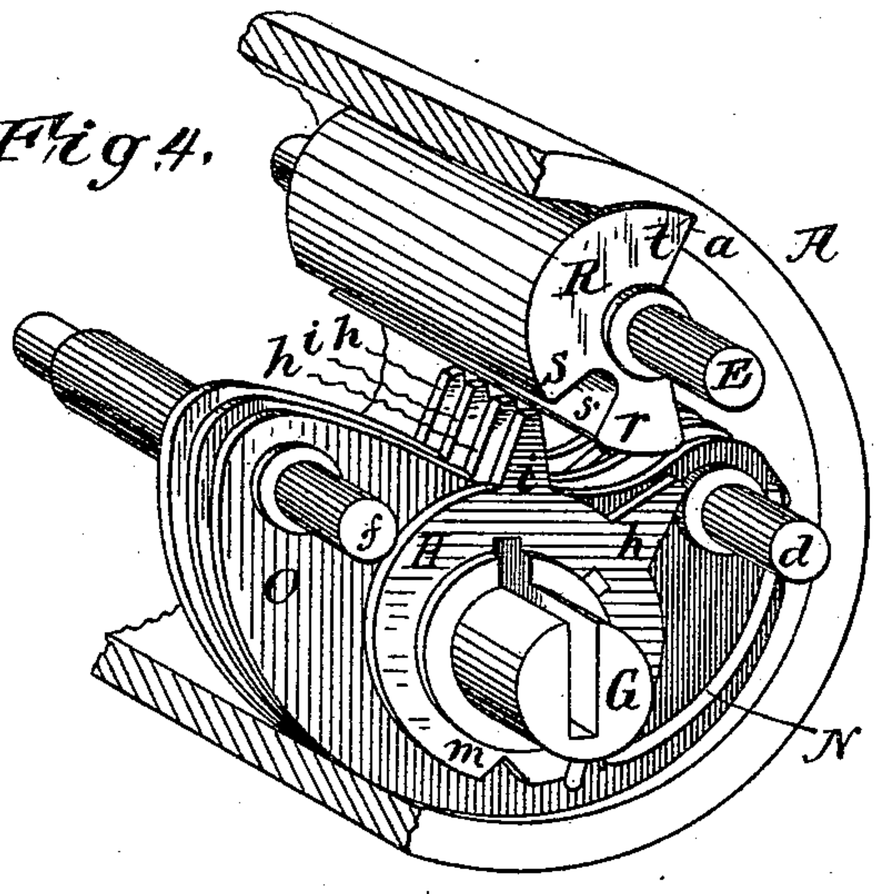


Fig. 6.

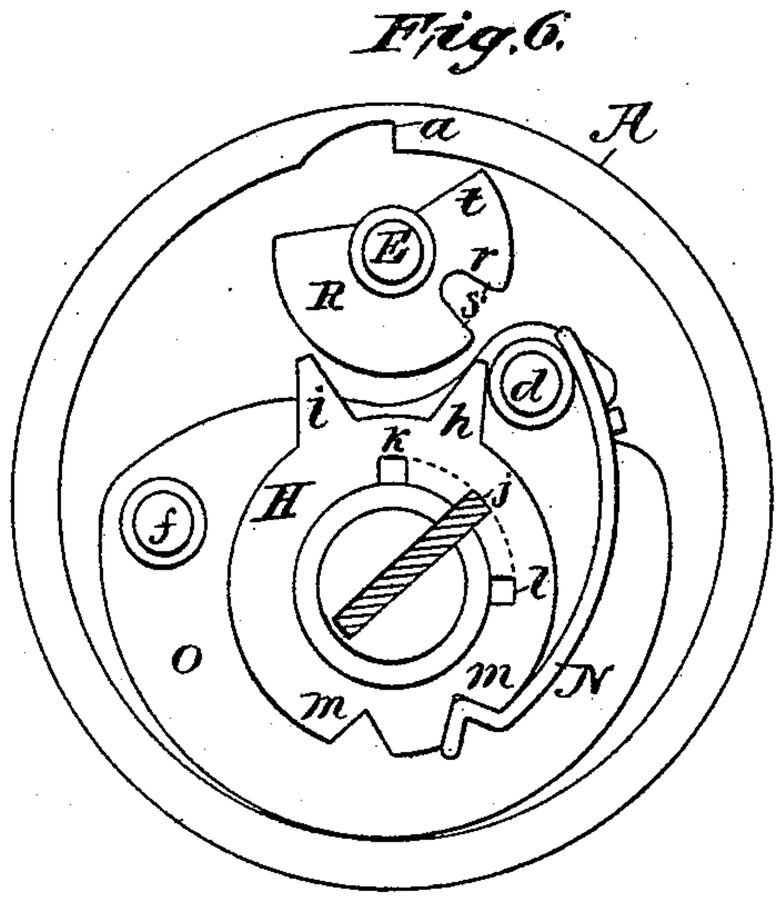


Fig. 5.

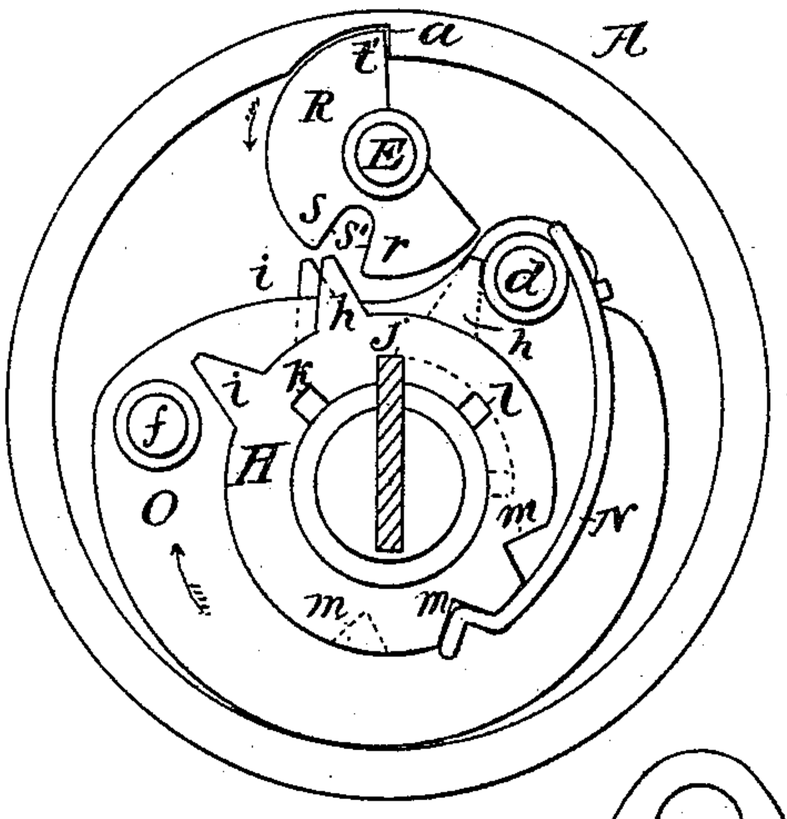


Fig. 7.

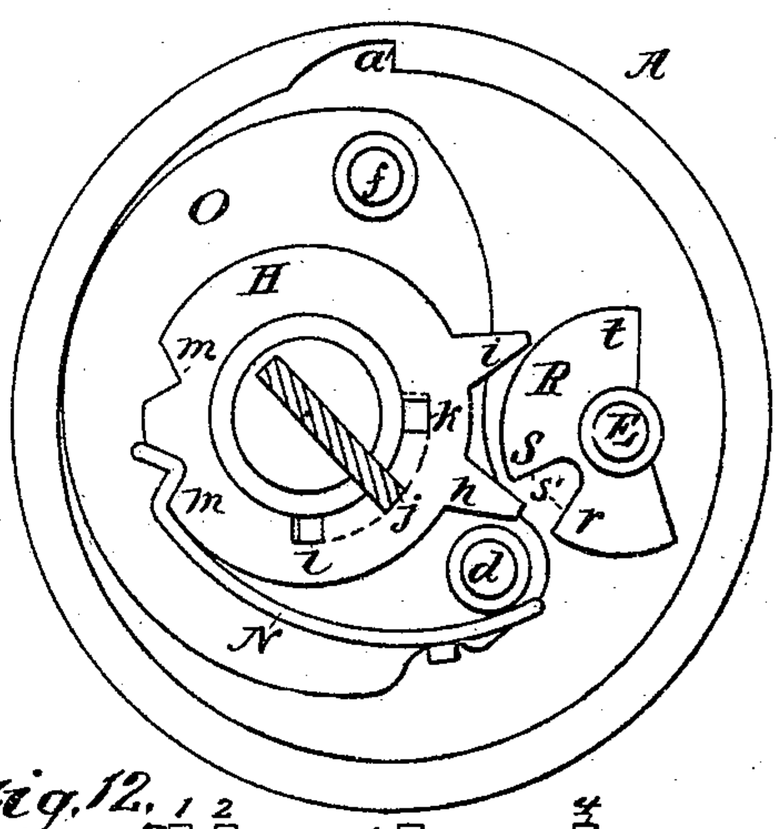
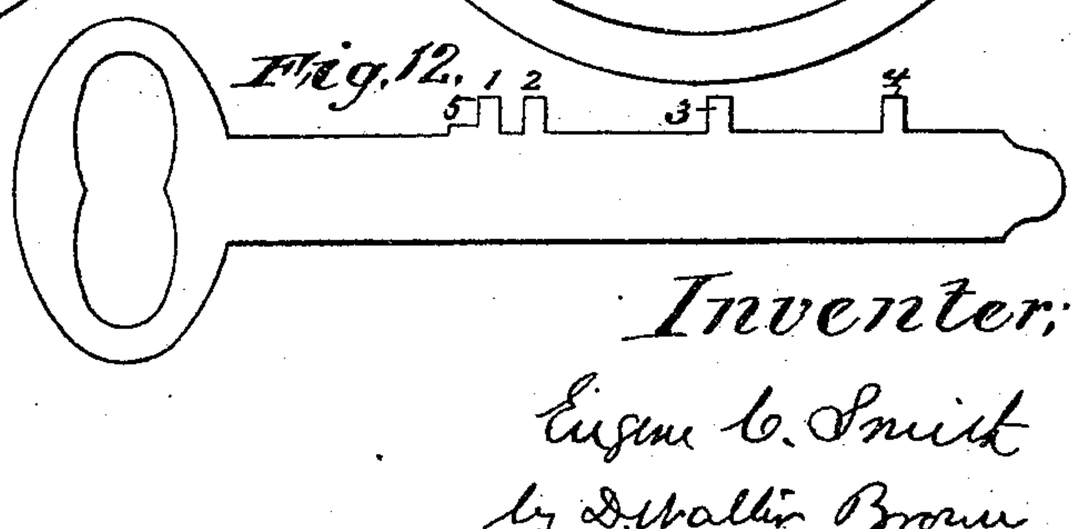


Fig. 12.



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(Model.)

3 Sheets—Sheet 3.

E. C. SMITH.

CYLINDER LOCK.

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Fig. 9.

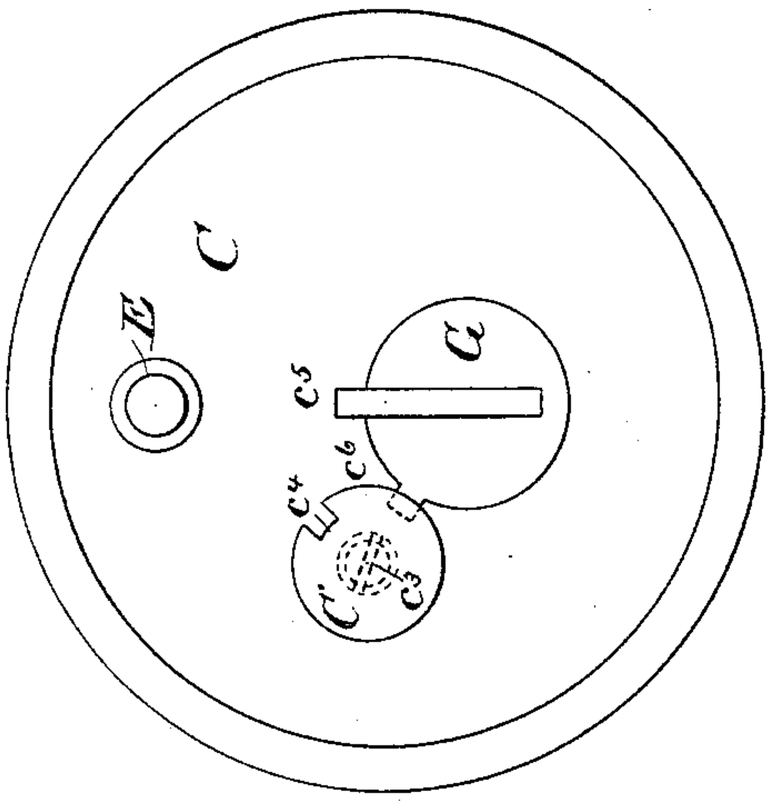


Fig. 8.

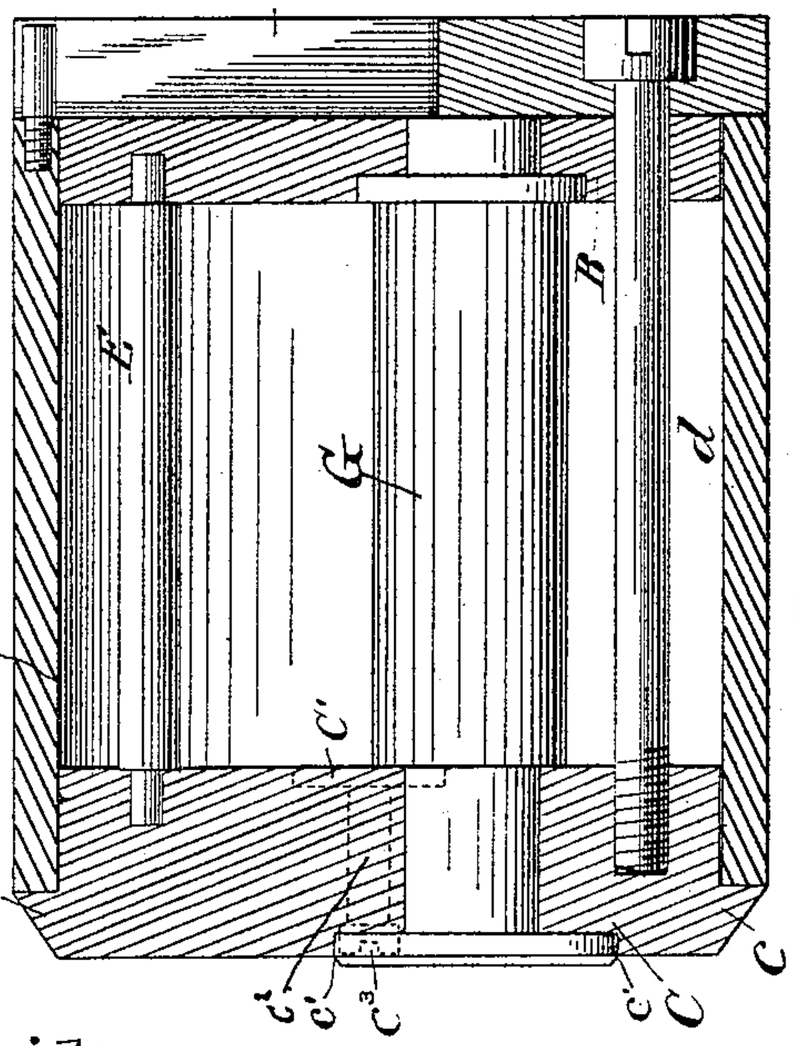


Fig. 11.

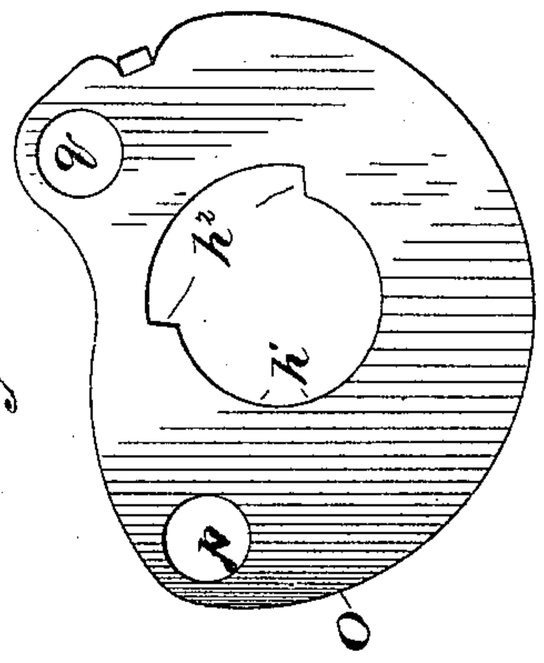


Fig. 11a.

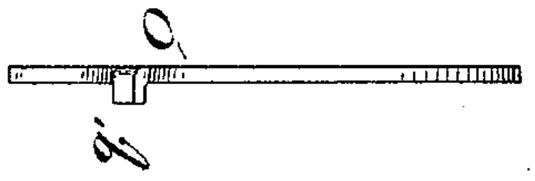
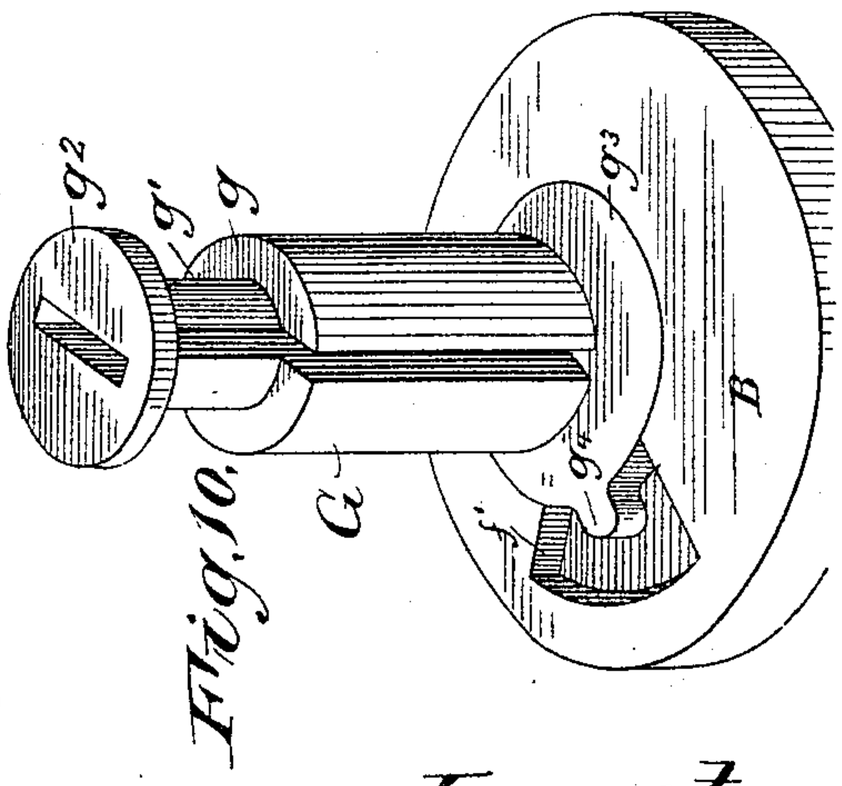


Fig. 10.



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Inventor:

Eugene C. Smith

by D. Walter Brown,

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UNITED STATES PATENT OFFICE.

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CYLINDER-LOCK.

SPECIFICATION forming part of Letters Patent No. 457,873, dated August 18, 1891.

Application filed September 6, 1890. Serial No. 364,177. (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 Cylinder-Locks, of which the following is a specification.

My invention relates to the class of locks known as "cylinder-locks;" and the object of my improvement is particularly to construct a combination cylinder-lock which can be locked by any one of a series of keys within the limits of the combination, but can only be unlocked by the particular key which was used in locking or by an exact duplicate of that particular key.

My invention also relates to special means and constructions employed for attaining this result, as hereinafter described.

The drawings which accompany the specification show my cylinder attached to a spring-latch, wherein the bolt is shot by a spring and withdrawn by mechanism when the same is actuated by a key in unlocking; but the cylinder is equally applicable to dead-locks, wherein the bolt is both shot and withdrawn by the mechanism.

Referring now more particularly to the drawings, Figure 1 is perspective view showing the cylinder attached to a mortise-latch. Fig. 2 is a view of the interior of the lock, showing the position of the cylinder and bolt-actuating arm when the lock is locked. Fig. 3 is a view of the interior, showing the same parts as Fig. 2, but in the unlocked position. Fig. 4 is a perspective view of the mechanism in the interior of the cylinder, the cylinder being broken away and some of the washers and tumblers being removed for the sake of clearness. Fig. 5 is a plan view of the mechanism in the cylinder in the locked position. Fig. 6 is a similar view, but showing the tumblers and locking-bar in the unlocked position just before the internal cylinder begins its rotation. Fig. 7 is a plan view of the mechanism when the internal cylinder has completed its rotation and the bolt is withdrawn. Fig. 8 is a longitudinal section of the cylinders, showing the key-cylinder and pins, but without the mechanism. Fig. 9 is a plan view of the top or key end of the cylinder, seen from below, showing the means for changing the combinations. Fig. 10 is a perspective view of the key-cylinder. Figs. 11 and 11^{A} are views of a washer. Fig. 12 is a view of a key.

The lock consists of an external case A, which is preferably of cylindrical shape with open ends, and which may be threaded into the side plate of the case W in the usual manner.

Cylinder A may be cast or otherwise manufactured, preferably of brass. At one side of the interior of the cylinder A is formed a notch *a*. This notch *a* is preferably parallel to the longitudinal axis of cylinder A and extends nearly the whole length of said cylinder A, and is intended to receive the head of the locking-bar or the end of an arm actuated by the locking-bar, as is hereinafter more fully described.

The "inner" cylinder, so termed, is formed of two cap-pieces B C, which fit the cylinder A with a working fit. The cap B may be formed to slip within the cylinder A, as shown, and the cap C, which is at the key end of the cylinder A, may have a flange *c* to fit over the cylinder A, as shown in Fig. 8. The cap-pieces B C are held at the proper distance apart, according to the length of the cylinder A, by means of pins *d* E *f*, as seen in Figs. 4 and 8, and one or more of these pins may be threaded to engage with threads in the caps B C, as, for example, the pin *d*. The said pins *d* E *f* are also utilized as pivots for the mechanism and as supports for the washers, as is hereinafter described.

The key-cylinder G is cylindrical in shape and centrally slotted to receive a key in the ordinary manner, and the said key-cylinder G is formed with a shoulder *g* to prevent its slipping through the cap-plate C, with a neck *g'*, a cap or key-plate g^2, a base-plate g^3, and a stop-pin g^4. To secure the cap g^2 on the key-cylinder G, the neck *g'* is slipped through the key-cylinder opening in the end plate C, as clearly shown in Fig. 8. The cap g^2 is then slipped on the neck *g'* and down into the cylindrical recess *c'* in the said end plate C, and

the end of the neck g' is then set up over the cap g^2 in the manner that the head of a rivet is set up. The bottom plate g^3 of the key-cylinder G enters a cylindrical recess in the end plate B, and the said end plate B also has a recess f'', in shape a segment of a circle, within which plays the stop g^4. Thus the amount of play of the key-cylinder is limited by the dimensions of the recess f'', which is proportioned for the amount of throw it is necessary to give the key in order to dissolve the locked combination of tumblers. In practice I have found that the arc of the recess f'' should be about forty degrees in addition to the width of the stop-pin g^4.

Turning upon the key-cylinder G as an axis there is a series of tumblers H, each capable of an independent motion upon the said key-cylinder G. The tumblers H are each preferably made of flat thin plates of metal and are approximately cylindrical in shape, and each, as said, turns freely upon the key-cylinder G, which passes through an opening in the center of the tumblers H. Each tumbler H has a projection h and an auxiliary cam or projection i, and also a recess j for a key-bit, and false recesses K l to either side of the true recess j. The false recesses K l are spaced from the true recess j a distance equal to the throw of the tumblers H, and consequently, whether any tumblers H be in the locked or the unlocked position, there will always be a right line of recesses, as observed, from the key-cylinder, and no indication will be given through the key-hole of what tumblers are locked and what are unlocked. By means of the stop-pin g^4 the movement of the key-cylinder G is limited to an arc equal to that from the center of recess j to center of recess K or recess l. Consequently the key-cylinder G can never be turned to a position in which it will be possible to detect from the key-hole the combination of tumblers on which the lock is set. Each tumbler H also has recesses m to receive the ends of springs N, as is common in tumbler-locks.

Between each pair of tumblers H is a washer O, Figs. 4 and 11, which is preferably a thin sheet of metal formed approximately like a segment of a circle, as shown in Fig. 11, and perforated with openings p q, which slip over the pins d f and hold the said washers O securely in place. The said washers O are also centrally perforated, as at h', to receive the key-cylinder G, which passes centrally through each washer, and on the side adjacent to the key-recesses j K l in the tumblers H each of said washers O has a slot h^2—in shape a segment of a circle—to permit of the play of the key. There is also on each washer O a tongue q', which is bent laterally, as shown in Fig. 11^A, and serves to press the springs N down upon the tumblers H.

Adjacent to the tumblers H and so as to be engaged by the projections h is a locking-bar R, which rotates on the axial pin E. This locking-bar R is straight longitudinally and is of a length equal to the combined thickness of all the tumblers and washers, so that the locking-bar R is capable of being engaged by every tumbler H, as indicated in Fig. 4. In cross-section said locking-bar R is a bent lever having arms r s and a head t, which head t in certain positions of the mechanism enters the recess a in the cylindrical case A and prevents the movement of the internal cylinder, as is hereinafter more fully described. The aforesaid arms r s of the locking-bar R are separated by a space s', within which space the projections h of the tumblers H play as the tumblers shift to their several positions. The manner of engagement of the tumblers H with the locking-bar R is therefore similar to the engagement of toothed wheels upon each other.

The means for actuating the bolt consists of an arm U, which is pivoted to the end plate B by the pin d. The said arm U also has a slot u, which plays upon a pin v, that is set in the stationary cylinder A. Thus, as the end plate B revolves during the locking and unlocking, motion is imparted to the arm U, which is caused to advance or recede, according to the direction in which the end plate B, together with the inner cylinder, is rotated, and thus the arm U may be made to impart motion to the bolt Y. In Figs. 2 and 3 the cylinder is shown applied to a spring-latch, and the arm U therein engages with an arm x of a bent lever X, which is pivoted at x'. The other arm x^2 of said lever X is curved and passes over a pin y on the bolt Y, and thus the said bolt is drawn back, as seen in Fig. 3. There is a spring y' for throwing the bolt Y forward in ordinary manner. For other types of locks the arm U may be made to engage with bolt Y in other ways than that shown, and a great variety of methods are well known to manufacturers of cylinder-locks, and I do not claim the bolt Y as a part of my invention. Moreover, it is apparent that I may pivot the arm U on the outer stationary cylinder and set the pin v in the inner rotating end plate B, and the arm U will be caused to advance and recede as before, but with a reversed movement.

In Figs. 8 and 9 are shown means for changing the combinations of the tumblers. In the end plate C there is a normal key-slit c^5, corresponding to the position of the slit in the key-cylinder G when the mechanism is in the locked position of Figs. 4 and 5, and also an auxiliary key-slit c^6, corresponding to the position of the slit in the key-cylinder G when the mechanism is in the position of Fig. 6. In a recess in the inner side of the end plate C is a circular plate C', which is turned by means of a pin c^2, having a slotted head c^3 to receive a tool for turning the said plate C', and the said plate C' has a notch c^4, which is normally turned away from the key-slit c^6, as shown in Fig. 9. It is evident that a key which is turned to the position of c^6 cannot be withdrawn from the lock until the plate

C′ is turned so that the notch c^4 comes in line with the key-slit c^6. The application of the said plate C′ to changing the combinations will be hereinafter described.

The operation of the mechanism is as follows: Suppose the lock be of the spring-latch type, the mechanism to be in the position of Figs. 4 and 5, and the head of the locking-bar R to be in engagement with the notch *a* in the cylinder-case A, as shown in said figures, the lock being set on some certain combination, as that the second, fourth, eighth, and eleventh tumblers are in the locked position, the said tumblers having been placed in that position and the others in the neutral position of Fig. 6 when the parts were assembled. Now a key having bits 1 2 3 4, corresponding to the combination on which the tumblers are set, is inserted in the key-cylinder G by way of the key-slit c^5 and turned in the direction of the arrow, Fig. 5. The bits of the key will engage the key-recesses *j* of the locked tumblers; but the said key will not engage any of the unlocked tumblers which are in the position of Fig. 6, and the said key will rotate said locked tumblers in the direction of the arrow. As the tumblers rotate, their projections *h* will engage with the arm *r* of said locking-bar R and will turn the locking-bar R to the position of Fig. 6, in which position the head *t* of said locking-bar R will have been drawn down below the notch *a* in the outer cylinder-case A, so that the whole of the internal mechanism and the end plates B C will be free to rotate within the cylinder A. When the said tumblers H have turned thus far, their further movement will be prevented by the pin *d*, as seen in Fig. 6, and at the same time the pin g^4 on the key-cylinder G will have stopped the turning of the key-cylinder G. The mechanism will now be in the position of Fig. 6, wherein all the tumblers will be in unlocked position; but the internal cylinder, composed of the mechanism and the end plates B C, will not have begun to rotate. Now continue to revolve the key and rotation will be imparted to said cylinder, which will revolve to the position of Fig. 7, in which position the arm U will have drawn back the bolt Y, as shown in Fig. 3. Now release the strain on the key and the spring *y′* will shoot the bolt Y forward, and said spring will also, through the lever X, tend to force back the arm U and restore the internal cylinder to the position of Fig. 6. This motion may also be aided by springs acting on the internal cylinder and arm U, which springs are not shown, or the internal cylinder may be returned to the position of Fig. 6 by reversing the movement of the key by hand. When the mechanism is in the aforesaid position of Fig. 6, the key will be opposite to the auxiliary key-slit c^6 in the end plate C; but the key cannot be withdrawn, because the shoulder 5 will now come against the plate C′. Consequently the key must be turned completely back to its first position, and in so turning it will rotate the certain combination of locked tumblers in a direction reverse to that of unlocking. The projections *h* of said tumblers will engage with the arm *s* of locking-bar R and will turn the said locking-bar R to the position of Fig. 5, wherein the head *t* enters the notch *a* in the stationary cylinder A and the arm *s* of said locking-bar R just clears the projections *h* of the locked combination of tumblers, as shown in Figs. 4 and 5. Should any attempt be made to turn the internal cylinder without a proper key, the locking-bar R will be forced down on the projections of the locked tumblers. Thus the head *t* of the locking-bar R cannot escape from the notch *a* except when the locked tumblers are rotated by the same key as shifted the said tumblers to the locked position.

The combination is changed in the following manner: The tumblers being in the position of Fig. 5, the certain key corresponding to the combination on which the lock is set is inserted in the key-cylinder and turned as before until the tumblers are stopped from further movement and take the position of Fig. 6, in which position, as before said, all the tumblers are in unlocked position. The key will now be in line with the auxiliary key-slit c^6. Now the plate C′ is turned by means of the screw-head c^3, which projects on the outer surface of the cap C, and the notch c^4 in said plate *c′* is brought over the auxiliary key-slit c^6. The key is now withdrawn from the lock and another key having a different combination of bits is inserted and turned back to the normal key-slit c^5. While so turning some new combination of tumblers will be shifted to the position of Fig. 5, and the locking-bar R will again engage the notch *a*. The plate C′ is then turned back to the position of Fig. 6 by means of its screw-head c^3, as aforesaid, so that the new key cannot thereafter be withdrawn until said key is turned completely back to its normal slit c^5. Thus the cylinder will now be locked on a different combination from the original combination, and proceeding in a similar manner as many changes in the combinations may be made as there are possible combinations from the number of tumblers. The auxiliary projections *i* on the tumblers H are so placed and shaped that when certain tumblers are in the unlocked position of Fig. 6 and certain others are in the locked position, Fig. 5, then the auxiliary projections *i* of such tumblers as are in the unlocked position will just clear the arm *s* of the locking-bar R, as shown in Fig. 5, and will allow the said locking-bar R to sweep by them to the position of Fig. 6; but should any one tamper with the lock and shift any of said unlocked tumblers forward a little in the direction of the arrow of Fig. 5 in an attempt to open the lock, then said projections of such tumblers will pass under the arm S of locking-bar R and will prevent said locking-bar from turning to free the locking-tumblers.

It is evident that instead of causing the locking-bar R to engage directly with the notch *a* in the stationary cylinder A, I may cause said locking-bar R to actuate an arm or lever, which will be thus thrown up into the said notch *a* when the tumblers are locked and will be withdrawn from said notch *a* when the tumblers are unlocked.

The essential feature of my invention is the direct or indirect engagement of a locking-bar which is connected with an internal cylinder and is actuated by tumblers with the external stationary cylinder.

The drawings show, as is evident, an internal cylinder composed of two end plates B C, connected by pins *d* E *f*, on which the mechanism is assembled, but without any internal cylindrical shell or case. It is evident, however, that I may employ an internal cylinder having such shell, which will in that case have a longitudinal slot, up through which the head *t* of the locking-bar R will project to engage with the notch *a* in the external cylinder; but the construction of the drawings is very cheap and efficient.

I claim—

1. A lock mechanism consisting of a series of tumblers, each of which is adapted to severally shift and to enter locking combinations independently of each of the other tumblers, and of a locking-bar actuated by said tumblers, said mechanism arranged to shift within a stationary case, and devices adapted to engage with the said stationary case, as described.

2. The combination, in a lock, of a stationary case having a notch, lock mechanism arranged to shift within said stationary case and consisting of a series of tumblers, each of which is adapted to severally shift and to enter locking combinations independently of each of the other tumblers, and of a locking-bar actuated by said tumblers, and devices adapted to engage with the stationary case, as described.

3. In a cylinder-lock, a key-cylinder traversing a central opening through a series of severally shiftable tumblers, and the said key-cylinder having a stop which engages with the lock-case at either limit of the play of the key-cylinder, as described.

4. Means for changing the combination of a key-lock, consisting of a shiftable key-cylinder having a slot to receive a key, a stationary plate in which the key-cylinder shifts, a normal key-slit in said stationary plate, an auxiliary key-slit in said plate corresponding to the position of the key when the tumblers are in unlocked position, and a plate pivoted on the said stationary plate, the said pivoted plate having a key-slit and over-lapping the said auxiliary key-slit in the stationary plate, as described.

5. In a lock, two cylinders which shift with respect to each other, and a bolt-actuating arm which is pivoted on one of said cylinders and oscillates about a pin which is set in the other cylinder, as described.

6. In a lock, a tumbler centrally perforated to receive a key-cylinder and having a true key-slot and false key-slots connecting with said central perforation, a projection on said tumbler for the purpose of actuating a locking-bar, and an auxiliary projection on the tumbler for the purpose of preventing the movement of the locking-bar, as described.

7. In a cylinder-lock, a shiftable locking-bar having arms adapted to be engaged by shiftable tumblers and having an arm adapted to engage with the stationary case of the cylinder, as described.

8. In a cylinder-lock, the combination of a series of severally shiftable tumblers, each having key-recesses and each having a projection adapted to engage a shiftable locking-bar, and also an auxiliary projection adapted to prevent the movement of the locking-bar, the said locking-bar having arms which are engaged by the projections on the tumblers, and also an arm which is adapted to engage with the stationary case of the said cylinder, as described.

9. In a lock, a washer centrally perforated to permit the passage of a key-cylinder, and the washer having a slot to permit play of the key, and also having a lateral projection which presses on a tumbler-spring, as described.

10. In a lock, a tumbler having a central perforation to permit of the insertion of a key-cylinder, a true recess connecting with said central perforation, and false key-recesses equally spaced to either side of the true key-recess and also connecting with said central perforation, as and for the purpose described.

Signed at New York, in the county of New York and State of New York, this 23d day of August, A. D. 1890.

EUGENE C. SMITH.

Witnesses:
FRANK J. HAYES,
LOUIS M. FULTON.