

M. G. CAMPBELL, EXECUTRIX.

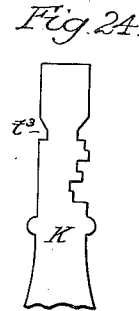
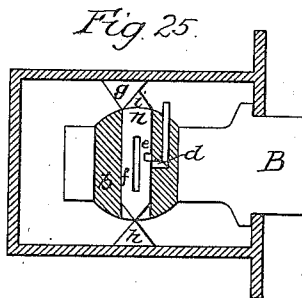
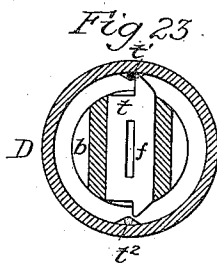
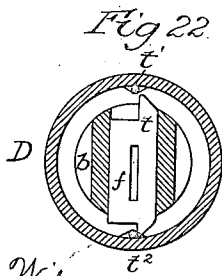
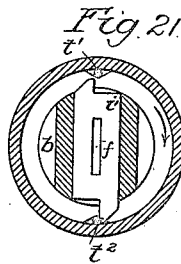
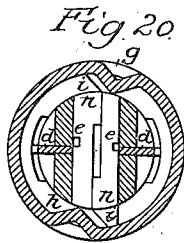
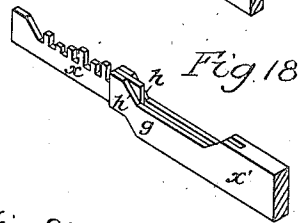
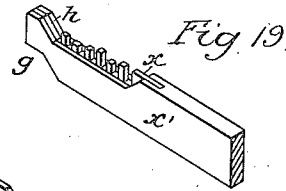
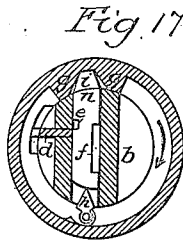
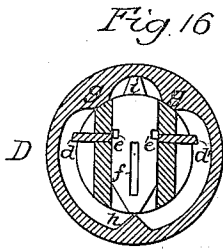
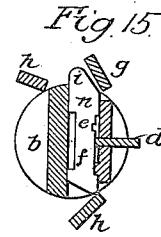
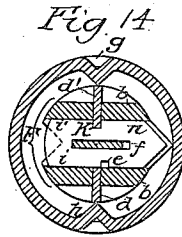
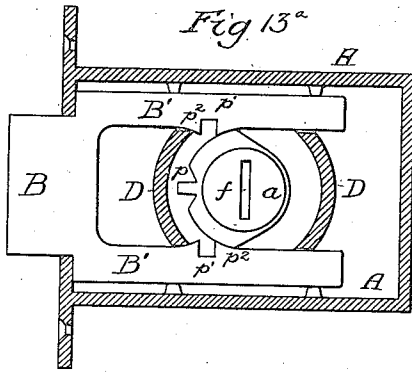
LOCK.

APPLICATION FILED MAY 27, 1918.

1,430,176.

Patented Sept. 26, 1922.

3 SHEETS—SHEET 2.



Witnesses
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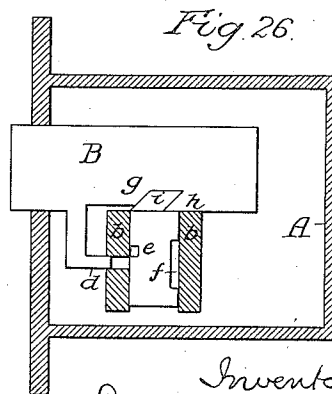
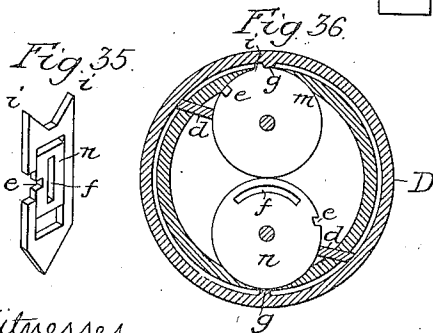
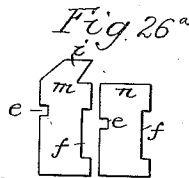
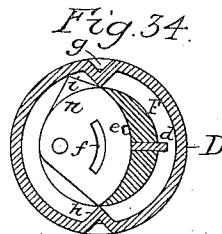
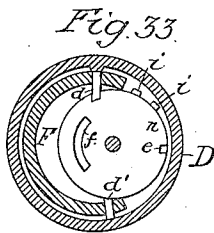
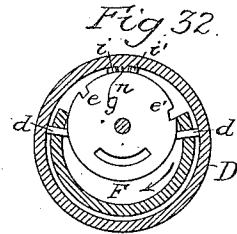
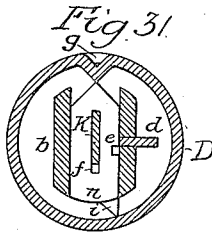
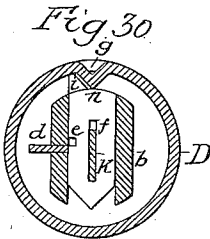
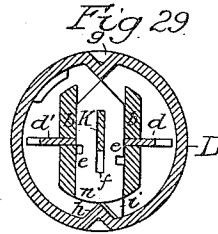
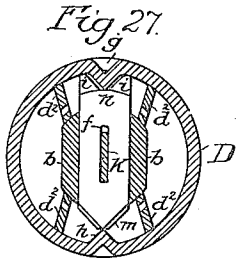
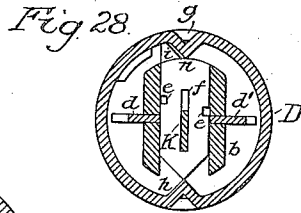
LOCK.

APPLICATION FILED MAY 27, 1918.

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3 SHEETS—SHEET 3.

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Witnesses

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UNITED STATES PATENT OFFICE.

DANIEL K. MILLER, DECEASED, LATE OF PHILADELPHIA, PENNSYLVANIA, BY
MARGUERITE G. CAMPBELL, EXECUTRIX, OF PHILADELPHIA, PENNSYLVANIA.

LOCK.

Application filed May 27, 1918. Serial No. 236,942.

To all whom it may concern:

Be it known that I, MARGUERITE G. CAMPBELL, a citizen of the United States, residing in Philadelphia, Pennsylvania, am the executrix of the last will and testament of DANIEL K. MILLER, deceased, who did invent certain Improvements in Locks, of which the following is a specification.

The object of my invention is to construct a lock in which a high grade of security is obtained, and which possesses the qualities of strength, durability, compactness, simplicity of construction, and cheapness of manufacture.

In the accompanying drawings

Fig. 1 is a longitudinal section of a mortise lock with my improvements;

Fig. 2 is a sectional plan view of the same, partly in outside view;

Fig. 3 is a sectional plan on the line 1—2, Fig. 1;

Fig. 4 is a transverse section on the line 3—4, Fig. 1;

Figs. 5, 6 and 7, longitudinal sections illustrating the operation of the lock;

Fig. 8 is a view illustrating the operation of the bolt-throwing device;

Fig. 9 a sectional view of the tumbler carrier, tumblers, and dog, showing the parts detached;

Fig. 10, a perspective view of the tumblers;

Figs. 11 and 12, perspective diagrams on a larger scale of part of the lock;

Fig. 13, a diagram illustrating the action of the tumblers, and

Figs. 13^a to 36, are views illustrating various forms of lock in which the main features of my invention are embodied.

In order to give a general understanding of my invention, I will first describe, on reference to sheet 1 of the accompanying drawings, a simple form of lock embodying the invention, and will afterwards set forth the various modified forms illustrated in the drawings in which the lock or parts of the same can be made without departing from my invention.

A represents the casing, which is constructed to fit a mortise in a door as usual, and in this casing slides a bolt B having a

stem B' which is adapted to the recessed portion of a cylinder D secured within the casing in any suitable manner.

Within the cylinder is a tumbler carrier which in the present instance is simply a skeleton frame composed of end plates *a* and side bars *b*, the end plates being journaled in the casing of the lock, so that the tumbler carrier is free to turn in the cylinder D, but has no other movement independently thereof.

The tumblers consist of flat plates arranged side by side, and fitting so snugly between the end plates *a* of the tumbler carrier that there is considerable friction, when one tumbler is moved upon another, so that if one tumbler is moved the others will move with it unless they meet with an obstruction sufficient to prevent such movement.

There are two sets of tumblers *m* and *n*, the tumblers *m* having at their upper ends projecting lugs *i*, and in the cylinder D are internal cams *g* and *h* located opposite each other and acting upon the tumblers in the manner explained hereafter.

In the tumblers are slots *f* forming a keyway, similar slots being formed in the opposite end plates of the tumbler carrier, in order to form a keyway through the lock and permit the insertion of the key from either side.

Each of the tumblers is notched on the edge as at *e* for the entrance of a dog *d* guided in one of the side bars *b* of the tumbler carrier.

The bolt operating device consists of a tooth *p* on one of the end plates *a* of the tumbler carrier, said tooth being adapted to a recess *p'* in the stem B' of the bolt.

The operation of this lock is as follows:

When the bolt is projected, the parts are in the position shown in Figs. 1, 5 and 11, all of the tumblers being elevated and supported by the cam *h*. On inserting the key, however, and turning it and the tumbler carrier in the direction of the arrow, Fig. 1, the lower ends of the tumblers leave the cam *h* and the lugs *i* of the tumblers *m* are brought under the influence of the cam *g*, whereby said tumblers *m* are depressed and carry with them the tumblers *n*, owing to the inti-

mate frictional contact of the two sets of tumblers.

As the movement of the tumblers m is a positive movement, due to the action of the cam g , the slots f in said tumblers m are so much longer than the corresponding portions of the key that the latter will not offer any obstruction to such positive movement of the tumblers, the notches e of which at the completion of the movement are all in line with the dog d .

The tumblers n , however, owing their movement to frictional contact with the tumblers m , can be stopped by the key at any desired point, hence the notches e of the tumblers n can be arranged in any desired relation to each other, the bits of the key being similarly arranged, in order to stop the movement of each tumbler n when its notch is in line with the dog. (See Fig. 12.)

The tumblers m do not come into contact with the key at all, so that the key need not be bitted with reference to said tumblers but only with reference to the tumblers n , hence, while all of the tumblers must be properly set in order to open the lock, the key need only be cut to govern the tumblers n , and hence can be much coarser than usual, without in any way impairing the security of the lock.

This will be understood on reference to Fig. 13, in which it will be observed that although the lock is a thirteen tumbler lock, the key has only six bits.

After the notches of the tumblers have all been brought into line, the continued movement of the cylinder brings the outer end of the dog d under the influence of the cam g and as the inner end of said dog is free to enter the notches of the tumblers, the dog is pressed inward by the cam, as shown in Fig. 6, and offers no obstruction to the turning of the cylinder to the position shown in Fig. 7, which movement is caused to effect the retraction of the bolt B , by reason of the engagement of the tooth p with the recess p' in the stem B' of the bolt, as shown in Fig. 8.

On imparting a reverse movement to the cylinder in order to project the bolt, as shown in Fig. 1, the dog d is first withdrawn from the notches of the tumblers and the latter are then elevated to their original position by engagement of their lower projecting ends with the cams h , the upward movement of the tumblers n being stopped by contact of the bottoms of the slots with the lower edge of the key, or, by contact of their upper ends with the cam g , or by both means, and the bitted upper edge of the key being then free from engagement with any of the tumblers, so that it can be readily withdrawn.

The ejecting of the dog d is effected by one of the tumblers m , marked in the drawing with a star, the notch e of this tumbler

being bevelled on the underside and the lower end of the tumbler being somewhat wider than the others, so that it will come under the influence of the cam h , and be slightly elevated before the other tumblers are acted upon.

Any desired number of tumblers may, however, have these beveled notches.

In the rear of the recess p' in the stem of the bolt, is a shoulder p^2 with which the plate a engages when the bolt is projected, so that the forcing of said bolt is prevented.

Having thus described the construction and operation of one form of my improved lock I desire to say that the main feature of the invention is the employment of two sets of tumblers, one set positively actuated, and the other set deriving their movement from frictional contact with the first, and this use of positive and friction tumblers I adhere to in all the various modifications of construction or arrangement of the tumblers or other portions of the lock which I will hereafter describe.

Owing to this feature of my invention, all springs in connection with the tumblers are dispensed with, and in consequence, very thin tumblers can be used, a large number of tumblers in a small lock being permissible, and a high grade of security being thus obtained, together with extreme simplicity of construction and economy of manufacture.

While preferable it is not absolutely necessary that the tumblers m should have notches to be brought into line for the entrance of the dog, as the tumblers m may have notches of such a length that said tumblers have no control over the movement of the dog but simply effect the necessary movement of the tumblers n .

When the tumblers m are constructed with notches as described, however, they add to the security of the lock, as in attempting to pick the lock both sets of tumblers m and n must be properly adjusted before the carrier can be turned to actuate the bolt, and as the tumblers are in frictional contact with each other, the movement of any one of said tumblers is liable to derange the other tumblers, so that the greater the number of tumblers which must be brought into line and held there, the greater will be the difficulty of picking the lock.

Even when the tumblers m are not constructed so as to necessitate a certain adjustment before the lock can be opened, said tumblers serve to increase the difficulty of picking the lock by conveying movement to the other tumblers and disarranging the same, and in this respect, the tumblers m are essentially different from a slotted frame carrying the tumblers n .

Figs. 13^a and 14 show a master key lock constructed in accordance with my inven-

tion, the carrier F having two dogs d , d' , each tumbler m having two lugs i , i' , one on each side of the cam g and both sets of tumblers being notched on both edges.

5 When the carrier is turned to the right by the special key the tumblers m are depressed by the contact of their lugs i with the cam g and the notches e of the tumblers are brought into line for the entrance of the dog d , but when the carrier is turned to the left by the master key, the tumblers m are depressed by contact of their lugs i' with the cam g and a different adjustment of the tumblers is effected in order to bring their notches e into line for the entrance of the dog d' .

10 The bolt B in this case has a stem with two arms, each recessed for the action of the tooth p of the plate a , and the latter is cut away or reduced on the side opposite the tooth so as not to interfere with the movement of one arm of the stem when the tooth is acting on the other arm of the same. (See Fig. 13^a.)

25 The cam h is double and acts upon the lower ends of the tumblers on either movement of the carrier and said cam h is shorter or lower than the cam g so that the projecting end of the dogs d d' clear it as the tumbler carrier F is rotated in either direction.

As shown in sheet 1 of the drawings, the cams g and h are struck up from the metal of the cylinder D. Various other plans of making the same may, however, be adopted, for instance, flat bars may be secured at proper angles, as shown in Fig. 15, so as to serve as cams, and the cylinder D may be dispensed with, undue movement of the tumblers or the detaching of the same from the carrier F being prevented, either by the dog or by a rib on one of the bars b , or by both plans, as shown. Solid cams forming part of a cast metal casing may also be used, as shown in Fig. 16. The latter is a master key lock in which, however, I have shown two cams g , each tumbler m having but one lug i .

30 In this lock the cam h is not reduced in height as in the lock shown in Fig. 14, but the dogs d d' are arranged above the center of the carrier F so that the movement of said carrier necessary for the operation of the bolt may be effected without the necessity of carrying either of the dogs past the cam h .

55 Fixed cams are not necessary for the operation of the tumblers. In Fig. 17 for instance I have shown a lower cam h pivoted in a recess in the casing. As the carrier F is turned in the direction of the arrow, this cam swings downward so as to permit the descent of the tumblers. The cam is acted upon by a spring which tends to throw the outer end of the cam inward or towards the center of the carrier, so that on the backward

movement of said carrier the cam is restored to its original position, and elevates the tumblers as soon as the latter are brought under the influence of the cam, or the cam may be moved both up and down by engagement with suitable lugs on the tumbler carrier.

In this lock I have shown a separate cam for operating the dog d , this cam being preferably formed in each end of the cylinder so as to act upon the opposite ends of the dog.

A pivoted cam may also be used in place of the upper cam g .

In the tumblers shown in Figs. 15 and 17 80 the keyway is in one edge instead of in the center, and if desired, projections on the tumblers may be brought into contact with the key instead of forming keyways in the tumblers.

85 In Figs. 18 and 19 I have shown a form of key which can be used with my improved construction and arrangement of tumblers, and which will render unnecessary the use of cams in the lock case or cylinder. This key is made in two parts x and x' which are suitably connected together so that they can slide upon each other but cannot be separated laterally.

In the portion x of the key are formed the notches and bits for the tumblers, and on the portion x' are formed the cams g and h whereby the tumblers are operated.

When the key is to be used, the portion x projects beyond the portion x' , as shown 100 in Fig. 18, and on thrusting the key into the lock, the said portion enters the keyway first until its further movement is arrested by suitable shoulders or stops.

On further pressing the key the portion x' 105 enters the keyway and the cam g acts upon the tumblers m so as to depress the same and apply the tumblers n to the bits of the portion x , the key finally assuming the position shown in Fig. 19. On withdrawing the key the tumblers are acted upon and raised by the cam h as the portions x' of the key is drawn outward, the portions x being retained by its engagement with the tumblers until the last one of the latter has been 115 raised.

It will be understood that the tumblers m are so constructed and the portion x of the key so notched that said tumblers m , when depressed, will be in the path of the cam h . 120

In Fig. 20 I have shown a duplex lock having tumblers adapted to engage with the notches in both edges of the key. In this lock the key is turned continually to the right, the tumblers and cams being so constructed and arranged in respect to each other that the key is released from the control of the tumblers when the carrier has completed a half revolution. The lock, however, may be operated in the manner before 130

described, the carrier being turned part way around to withdraw the bolt and permit the withdrawal of the key.

This lock may be so modified on the principle of the master key lock, as described, that a complete or almost complete revolution of the carrier will be necessary in order to withdraw the bolt, two keys being required, the first for imparting the first half turn to the carrier, and the second for completing the movement. This form of lock is of value for safe-deposit boxes or drawers, as the first key may be in the possession of the attendant at the vault, while the second is held by the owner of the box or drawer, the use of both keys being necessary before the box or drawer can be opened.

In the lock shown in sheet 1, the rotation of the tumbler carrier is arrested by the contact of the stem of the bolt with the end of the lock casing.

In some locks, however, it may be desirable to stop the movement of the tumbler carrier at a certain point, independently of the movement of the bolt, and in such cases I can use a stop tumbler *t*, one form of which is shown in Figs. 21, 22 and 23.

When the bolt is projected this tumbler occupies the position shown in Fig. 21 and hence does not interfere with the turning of the carrier in the proper direction, as indicated by the arrow.

Just before the carrier reaches the limit of its movement in this direction however, one end of the tumbler *t* is brought under the control of a lug *t'*, and said tumbler is thus depressed so as to bring its opposite end within range of a stop lug *t''*, as in Fig. 22, and thereby prevent the further forward movement of the carrier.

When the tumbler *t* is in the position shown in Fig. 22, a portion of said tumbler occupies a recess *t''* in the key (Fig. 24) the rear edge of this recess being beveled, so that as the key is withdrawn the tumbler is moved to the position shown in Fig. 23.

On a continued movement of the tumbler carrier in the direction of the arrow, the same operation takes place, the lug *t'* in this case, however, acting as a stop and the lug *t''* as the means of actuating the tumbler.

It is not essential that the tumbler carrier should be caused to rotate as in some cases it may be secured to and move with the bolt, the tumblers being actuated by cams in the casing and the dog being under control of one of said cams, as shown for instance in Fig. 25.

In some forms of lock the tumbler carrier *F* may be stationary and the bolt may be controlled by the cylinder *D*, the latter being so constructed as to be free to turn on the carrier *F*, and being furnished with a knob or handle for convenient manipulation.

The key in this case would be thrust into

the keyway and the cylinder *D* then turned so as to actuate the tumblers, dog and bolt.

The use of a dog in connection with the tumblers is not essential to my invention, as in some cases the bolt may have a stump adapted to enter the notches of the tumblers, one form of this device being shown in Fig. 26. In this case the key is first inserted, and a sliding movement is then applied to the bolt, so that a cam *g* on the latter will cause the proper adjustment of the tumblers before the stump *d* on the bolt enters the notches of the tumblers or the cylinder *D* may have internally projecting plates forming notched stumps, which are the counterpart of the notched edge of the key and which will prevent the rotation of the carrier *F* until the tumblers have been properly adjusted. Such plates are shown at *d''* in Fig. 27.

A suitable stop on the carrier may be used to limit the upward movement of the tumblers *n*, in which case the said tumblers may be moved in both directions by frictional contact with the tumblers *m*, the latter only being acted on by the cams *g* and *h*, and if desired, both sets of cams may act upon the upper ends of the tumblers *m*, for instance, one cam *g* may act upon one edge of each tumbler to depress it, while on the opposite motion the other cam *h* will act upon the opposite edges of the tumblers with a lifting effect. A construction of this character is shown in Fig. 26.

In this case each tumbler *m* has a projection *i* beveled on one edge and undercut on the opposite edge, a beveled shoulder *g* on the bolt *B* acting on the beveled edge of each of the tumblers *m* to depress it as the bolt is being retracted and a beveled shoulder *h* on the bolt acting on the undercut edge of each tumbler *m* to raise the latter when the bolt is being projected. Side views of the tumblers *m* and *n* employed in this class of lock are shown in Fig. 26^a. In Fig. 26 the tumbler *n* is shown in front of the tumbler *m*, only the projection *i* of the latter being visible.

The safe deposit lock before described was a duplex lock (Fig. 20) but a single lock may also be used for this purpose, such a lock being illustrated in Figs. 28 and 29. In this case the dogs are operated by an independent cam similar to that shown in Fig. 17, the cam acting upon the ends of the dogs.

The attendant first turns the tumbler-carrier to the extent of a half revolution, the tumblers being adjusted for the dog *d*, and the dog *d'* being free from the influence of the cam. At the end of the half movement the tumblers are moved by the cam *g* as shown in Fig. 29, so as to release the attendant's key and leave the tumblers in condition for the entrance of the owner's key,

by which the tumbler carrier is turned the final half of the revolution, the tumblers being adjusted for the entrance of the dog d' , and the dog d being free from the influence of the cam. Stop tumblers and cams of the character shown in Figs. 21, 22 and 23 should for convenience, be used in this lock to prevent undue movement of the tumbler carrier by either the attendant or the owner.

I propose to combine with a two-key lock a bolt-throwing device of such a character that the half revolution of the tumbler-carrier by the attendant has no effect upon the bolt, which is retracted on the third quarter of the revolution, this being the first movement of the owner's key, the last quarter of the revolution or second movement of the owner's key serving to again project the bolt and close the lock, leaving the parts in their original positions, so that while the lock can be closed by the owner without the assistance of the attendant, the co-operation of both, as above described, is necessary before the lock can be opened.

Two cams g and h are not necessary for the proper operation of the tumblers, and in Figs. 30 and 31 I have shown a lock in which a single cam g serves both to depress and elevate the tumblers, thus, on first turning the tumbler-carrier from the position shown in Fig. 30, the tumblers will be depressed by the cam, but when the carrier has made a half revolution the said cam will have acted upon the opposite ends of the tumblers to elevate or restore them, as shown in Fig. 31, another half revolution bringing the parts to their original position.

In this case, however, the last half of the revolution of the tumbler-carrier is lost motion, hence I prefer to use two cams in locks of this class, that is to say, sliding tumbler locks.

The objection is not, however, applicable to a lock having rotating tumblers, such as shown in Figs. 32 and 33. In this lock the tumblers are circular disks and are hung to a pin in the carrier, the key slots being curved and the key correspondingly shaped, although the keyhole may be flat, if desired.

The lock shown is a master key lock, and on turning the carrier to the right, the projection g will act upon the lugs i of the positive tumblers and cause the latter to turn upon their pivots so as to bring their notches e and those of the frictional tumblers into line for the entrance of the dog d , as shown in Fig. 33, the projection g acting on the lugs i to restore the tumblers on the backward movement, and on turning the carrier to the left, the projection will act upon the lugs i' to set the tumblers for the dog d' , the lugs i being acted upon

by the projection on the backward movement in order to restore the tumblers to their original position.

In Fig. 34 I have shown a lock with vibrating tumblers in accordance with my invention, the action of these tumblers being substantially the same as that of the other tumblers shown and described.

In all of the locks which I have thus far described the tumblers m and n have been alternated and their sides have been in frictional contact. This construction, while preferable, need not be adopted in all cases in carrying out my invention, as the tumblers n may be actuated by frictional contact of their edges with the tumblers m . In Fig. 35 I have shown one way of imparting this edge friction, the tumblers m being slotted for the reception of the tumblers n and both tumblers having notches for the entrance of the dog.

In Fig. 36 I have shown a form of rotating tumbler lock in which the friction tumblers n are actuated by contact with the edges of the tumblers m , the edges being, if desired, grooved to increase the frictional surface. In this case the key is inserted into the keyway in the tumblers n . A dog is used for the tumblers m , however, as well as for the tumblers n , so that both sets of tumblers must be properly set before the lock can be opened.

It will be noticed that in my improved lock the tumblers are arranged to move in a direction transversely to the length of the key, so that the edge of the latter instead of the end is fitted for the reception of the tumblers, thus giving greater length available for the formation of the bits and permitting the insertion of the key from either side of the lock. This construction is not absolutely essential to the main feature of my invention, nor is it new in itself, but when combined with my improved method of actuating the tumblers it becomes of value in adding to the difficulty of picking the lock, as the greater the number of tumblers, the more chance is there that those first set by the picking instrument will be deranged in endeavoring to set the others, and in this way the likelihood of complete derangement of the tumblers is increased.

I claim:

1. A lock in which are combined a tumbler carrier, a set of tumblers having a positive movement, a set of tumblers the movement of which is due to frictional contact with the positive tumblers, and which are moved towards the bitted face of the key by such contact and a device independent of said tumbler carrier whereby the movement of the positive tumblers is effected.
2. A lock in which are combined a tumbler carrier, a set of tumblers having a posi-

tive movement, a set of tumblers the movement of which is due to frictional contact with the positive tumblers, and which are moved towards the bitted face of the key by such contact a device independent of said tumbler carrier whereby the movement of the positive tumblers is effected, and a bolt the movement of which is dependent upon the adjustment of the tumblers, said bolt being distinct from the tumbler carrier.

3. A lock in which are combined a tumbler carrier, a set of tumblers having a positive movement, a set of tumblers the movement of which is due to frictional contact with the said positive tumblers, and which are moved towards the bitted face of the key by such contact a device independent of said tumbler carrier for imparting movement to the positive tumblers, and a bolt the movement of which is governed by that of the tumbler carrier.

4. A lock in which are combined a bolt and bolt operating device, a tumbler carrier having a set of positive tumblers and a set of frictional tumblers, which are moved towards the bitted face of the key by frictional contact with such positive tumblers a device independent of said tumbler carrier for operating said positive tumblers, and a dog or equivalent device whereby the movement of the bolt operator is obstructed except the tumblers are properly adjusted.

5. The combination of a casing, a tumbler operating device, a set of positive tumblers, a set of friction tumblers, which are carried towards the bitted face of the key by frictional contact with the positive tumblers a tumbler carrier free to rotate but having no other movement in the casing, an obstructing device, and a bolt the movement of which is governed by that of the tumbler carrier.

6. The combination of the tumbler carrier having a set of positive tumblers and a set of friction tumblers, which are carried towards the bitted face of the key by fric-

tional contact with the positive tumblers a cam *g* whereby the positive tumblers are moved in one direction, and a cam *h* whereby said tumblers are moved in the opposite direction.

7. The combination of the tumbler carrier having a set of positive tumblers, and a set of friction tumblers, with cams *g* and *h*, one for moving the tumblers in one direction, and the other for moving the tumblers in the opposite direction, the friction tumblers being shorter than the positive tumblers whereby they will not be acted upon by the cam *g* but will be carried by the positive tumblers into range of the cam *h*, substantially as specified.

8. The combination in a lock, of a casing, of a set of positive tumblers and a set of friction tumblers, a dog adapted to enter notches in the tumblers, a carrier for the dog and tumblers movable in the lock casing, and a device whereby the operation of the positive tumblers and of the dog is effected.

9. The combination of the tumbler carrier, the dog, and the tumbler operating device, with the positive tumblers and friction tumblers, said tumblers having therein notches for the reception of the dog and one or more of said tumblers having its notch beveled for effecting the release of the dog.

10. The combination of a tumbler carrier, a dog, and a tumbler operating device, with positive tumblers and friction tumblers, said tumblers being notched for the reception of the dog and one of said positive tumblers projecting beyond the others, so as to be actuated in advance of the other tumblers and said projecting tumbler having its dog receiving notch beveled so as to eject the dog.

In testimony whereof, I have signed my name to this specification.

MARGUERITE G. CAMPBELL,
Executrix of Daniel K. Miller, deceased.