

J. D. CRAIG.  
COMBINATION LOCK.

No. 488,518.

Patented Dec. 20, 1892.

Fig. 1.

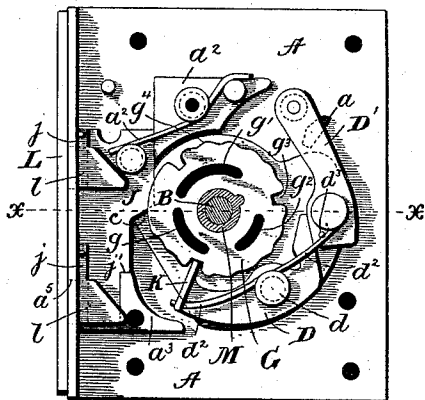


Fig. 2.

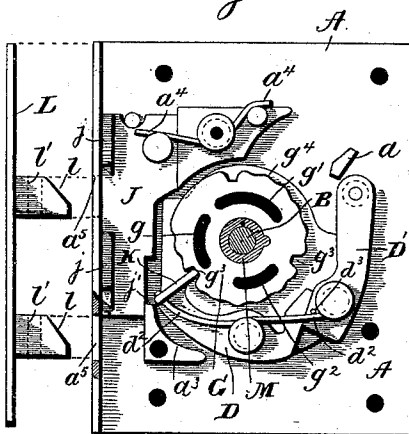


Fig. 3.

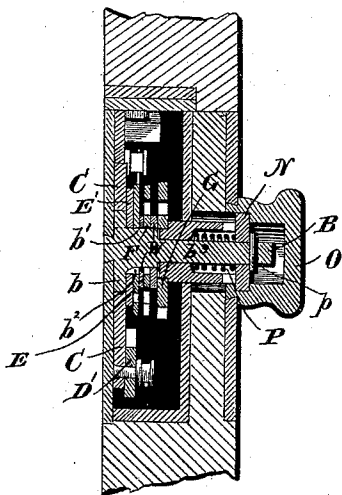
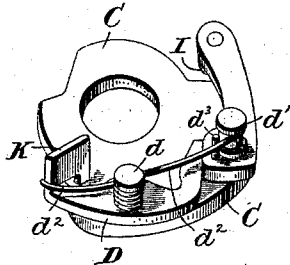


Fig. 4.



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(No Model.)

2 Sheets—Sheet 2.

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Fig. 5.



Fig. 6.

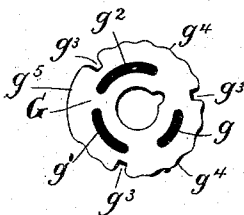


Fig. 8.



Fig. 7.

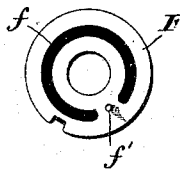


Fig. 9.



Fig. 10.

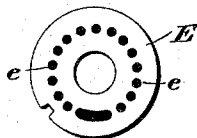


Fig. 11.

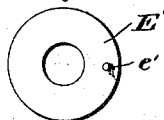


Fig. 12.

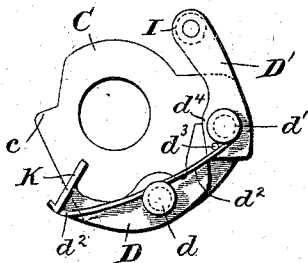
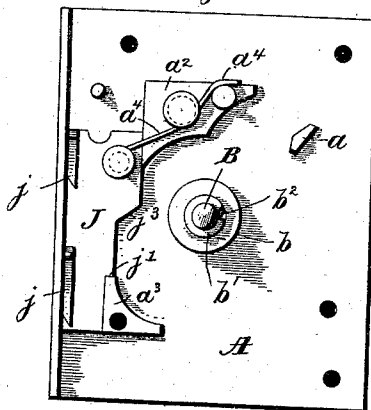


Fig. 13.



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# UNITED STATES PATENT OFFICE.

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## COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 488,518, dated December 20, 1892.

Application filed May 28, 1891. Serial No. 394,355. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES D. CRAIG, a citizen of the United States, residing at Rogers Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Combination or Permutation Locks, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to locks of the class known as combination or permutation locks, wherein a knob is used for locking and unlocking without the use of a key. It has for its object to provide a lock suitable for chests, trunks, valises, desks, drawers, book cases, post office boxes, &c., and when made of a larger size, suitable for night locks for doors.

The invention consists in the various constructions and combinations of parts expressed in the claims.

The general purpose in view in making this invention has been for the production of a lock having a spring bolt provided with one or more catches to engage one or more wedge-shaped hasps, and to employ therewith a series of tumblers with a keyless manipulating mechanism, whereby to insure great security in the capabilities of the lock itself, and to avoid altogether the necessity of carrying a key.

In the accompanying drawings, Figure 1 is a plan view of the inside of the base plate of the lock, showing the hasp plate locked fast to the lock proper and presenting a general plan view of the operating mechanism,—the tumbler-key engaging in notches of the tumblers, in the position they sustain to each other at the moment just previous to unlocking. Fig. 2 is a similar view excepting that it shows the spring bolt pushed to its extremelimit against its spring, in the unlocking movement;—the locking catches being entirely free from engagement with the hasps, which are shown as withdrawn from the lock case. Fig. 3 is a central sectional view on the line  $x-x$  of Fig. 1, showing sectional portions of the operating mechanism assembled on the lock standard,—that is the cam-plate around the enlarged base of the standard, the tumblers around the super-base, and the driving sleeve around the upper and smaller portion of the standard and connecting the upper tumbler with the

knob. Fig. 4 is a perspective view of the cam-plate carrying the compound lever provided with the tumbler key. Figs. 5 to 11 inclusive, are plan views of the various parts to be assembled on the standard. Fig. 12 is a plan view of the cam-plate, and the compound lever carried thereupon. Fig. 13 is a plan view of the base plate, with the cam-plate and its superimposed parts removed, the locking catches of the spring bolt being free from engagement with the hasps (not shown in said figure), the spring bolt being in its normal or resting position.

Heretofore a cam-plate carrying a lever and key has been used in connection with a driver, an index plate or disk, and a series of tumblers, as shown in my patent granted August 13, 1889, No. 408,795, which was designed for service, principally, as a door lock for houses, stores, &c., and numerous constructions of somewhat similar nature, have been devised, but, in many cases, they have been complicated and not so compact and simple in construction as to meet the requirements for a lock combining with compactness of organization great security against lock picking, and yet be easy for operating in daylight or dark, and capable of a very large number of different combinations. I have arranged in this construction a lock after the same general plan of that shown in the above patent, making use, however, of a compound lever for carrying the tumbler key, a somewhat different construction of tumblers, and a sliding plate or bolt having catches for engaging within notches in the sides of wedge-shaped hasps affixed to a plate suitable for being attached to a lid of a chest or trunk. The base plate A is provided, on its inner surface, with a switch cam block  $a$ , and with two lugs  $a^2 a^3$ , each having an inner concave surface and with a standard B, having a base portion  $b$ , and a super-base portion  $b'$ , both larger than the top portion  $b^3$ , of the standard,—the super-base portion  $b'$  being provided with a groove  $b^2$ , for receiving the keys of the washers W which are placed between the tumblers. The cam-plate C, by means of its central opening, is placed around the base  $b$  of the standard B, and then follow the tumblers in their regular order. The first tumbler is a two-part tumbler comprised of the parts E

and E', and is the first placed on the standard, after which are placed the other tumblers F and G. The cam-plate C carries a spring lever D provided with a tumbler key K and having a pivot  $d$ ,—and a lever D' for operating the lever D and having a pivot  $d'$ . One end of the spring  $d^2$  secured by its middle part around the projecting end of pivot  $d$ , rests upon the top of the tumbler key K provided at one end of the lever D, while the other end of the spring  $d^2$ , rests on the pivot  $d'$  generally, but,—for brief periods of time, on the pin  $d^3$ . The lever D' is provided with a friction pin, and preferably with a friction roller I on said pin, which roller or pin acts on the different sides of the switch cam  $a$  rigidly secured to the inner side of the base plate A. The roller I passes along the curved or inner side of the switch cam block  $a$ , as the cam-plate C carrying the compound lever D D' is forced back in the act of unlocking, and returns on the other side (the long straight side) of the switch cam block  $a$ , when the cam-plate C is being returned to its normal resting position, the rear end of the spring  $d^2$  taking a bearing on pin  $d^3$  for a moment (when the lever D' is pressed inwardly by the inside face or the cam-block  $a$ ), and thereby throwing the lever D' outward, and its roller I around to the long side of the switch cam-block  $a$  to return by the way of that side to its normal resting position. The lever D' presses by its cam-like part  $d^4$ , acting against the contiguous end of lever D immediately following the unlocking of the bolt and while the cam-plate C is finishing its movement in the unlocking direction, thereby elevating the other end of lever D and carrying the tumbler key out of the tumbler notches, whereupon the spring bolt J jumps back into its resting position whirling around the cam-plate C and its compound lever D D' to await the time of another unlocking. The sliding spring bolt J provided with the catches  $j, j$ , is held in position against the front flange of the base plate A by the lugs  $a^2, a^3$ , formed on the inner side of the base plate, the spring  $a^4$ , constantly pressing the bolt toward its resting position, wherein its shoulder  $j'$  (as shown in Fig. 1), abuts against the lug  $a^3$ . The hasp plate L has wedge-shaped hasps  $l, l$  for passing through openings  $a^5, a^5$  in the flange of the base plate, the wedge faces serving to force the spring bolt back against its spring  $a^4$ , and when the hasps have been forced into the lock case their full length, the spring bolt, by its catches  $j, j$ , engaging the notches  $l', l'$  in the sides of the hasps, fastens the hasps  $l, l$ , and the hasp plate L to the lock proper.

The cam-plate C is provided with a central aperture fitting over the base portion  $b$ , first placed in position with its cam shoulder  $c$  engaging against the incline  $j^3$  of the spring bolt J. The first tumbler, made up of parts E E', is then put in position, its central opening admitting the super-base  $b'$ , the tumbler

resting upon the base  $b$  in the same manner as the corresponding parts are placed in the patented lock above referred to. The part E is provided with a similar series of holes  $e$  for the pin  $e'$ , of the part E' to engage in, with the difference of having a slot intervening in the annular series of holes. Then a keyed washer W is placed on the standard B with its key in the slot  $b^2$ . Then the tumbler F is placed on the standard, and another washer with its key in the slot  $b^2$ , and the end of pin  $e'$  entering the annular slot  $f$ . The index tumbler G is next placed on the standard, the end of pin  $f'$  entering one of the arc-shaped slots in the tumbler G. This second washer W is somewhat thicker than the first washer, for the purpose of receiving the pressure of the spring pressed sleeve M, that connects the upper (index) tumbler with the driving knob, it being important that the tumblers with their intervening washers be held closely together under light spring pressure. The thick washer prevents the spring pressed sleeve M from resting on the top of the super-base  $b'$ , in which case the pressure of the sleeve M would not extend to the tumblers and washers below the top or index tumbler. In other words, the tumblers and washers around the super-base  $b'$  are, in cross section, of such combined thickness as to extend slightly above the top of the super-base, the thick washer having about a half of its plane body above the top of the super-base.

The index tumbler G, as illustrated, is provided with an elevated smooth arc-shaped peripheral surface  $g^5$ , and with the three arc-shaped slots  $g, g', g^2$ , in its body, and has three radial notches in its periphery, the arc-shaped slots being of a size, in cross section, adapting them to receive the end of pin  $f'$  of tumbler F, and the radial notches in the periphery being adapted to receive the key or catch piece K of the lever D. There are five serrations  $g^4$  in the periphery passing from one radial notch to another, excepting at that part having an elevated smooth arc-like surface where there are but two serrations. It is not intended to limit either the arc-shaped slots, the radial notches, or the serrations to the precise number shown. It will be observed that the arc-shaped slots have the one corresponding end of each so placed that the pin  $f'$  of the tumbler F will come either below the hollow portion of a serration or below a radial notch, or below where the hollow of a serration would be were they continued from radial notch to radial notch on the same scale in the periphery between the two radial notches having the intervening arc-like smooth surface, dispensing with the smooth elevated arc-shaped surface. The other end of each of said arc-shaped slots will not allow the pin  $f'$  engaging operatively therein, to come directly beneath either the hollow of a serration or the apex of a tooth but half way between. It will be further observed that the radial notches  $g^3$ , come directly in the hollow

of what otherwise would be regular serrations. The result of this construction is that when the lock is set on a combination, the tumbler key will drop and hit between the top and the bottom of a serration when the knob is turned in one direction, providing it would not so hit if turned in the other, in an attempt to find the combination;—and as no one, without previous knowledge as to which direction to commence turning to get the combination, can obviate this liability of being confused and frustrated, it adds an embarrassing obstacle to one attempting to pick the lock. As this index tumbler is reversible its adaptability for furnishing combinations is thereby doubled. When, however, it is reversed, the order of commencing the turning of the tumblers by the knob in picking up the combination must be changed. Thus if the knob turns to the right in commencing in one case, it turns to the left in commencing in the other, because the end of the arc-shaped slots for receiving and allowing the end of the pin *f'* to be operatively engaged therein is reversed.

The index tumbler *G* is provided at its center with a circular opening to fit around the upper portion of the standard *B*, and yet allow room between it and the standard for the reception of the diminished lower end of the sleeve *M* that is connected at its other end by a cross piece *N* with the lock knob *O*. The cross piece *N* has a central circular aperture passing over the top portion of the standard *B*, the ends of said cross-piece passing within slots in the upper end of the sleeve *M* and extending into grooves in the recessed interior of the knob *O*, while a coiled spring *P* is placed in the hollow portion of the sleeve (around the standard), and resting on an interior shoulder near its lower end to press the sleeve down, and thereby slightly compress the tumblers and washers together, the upper end of the spring abutting against the underside of the cross-piece *N*, which latter is securely held from slipping upward on the standard by means of a pin *p* passing into the standard above the cross-piece. The top of the standard *B*, the cross-piece *N*, and the pin *p* are inclosed within the hollow or recess in the rear portion of the knob *O*. The lower end of the sleeve is provided with a spline which fits within a groove at one side of the central opening of the tumbler *G*, thus keying the two parts together, so that by turning the knob and its connected sleeve in one direction or the other, the said tumbler is rotated with it.

The raised peripheral portion *g*<sup>3</sup> of the index tumbler *G* forms a smooth arc-shaped surface on which the key may rest and glide over at such a height as not to be within reach of any portion of either of the other tumblers. This is designed as a part to commence counting from in either direction in finding a known combination. Also, it must be used, as a part to count from when the cap plate of the casing is removed, to ascertain

just what number of clicks or tremors are required in counting in one direction or the other for the combination the tumblers happen to be set on. The tumbler *G* being the last tumbler is not provided with a pin to be changed from one side to the other, as is a necessity in the case of tumbler *F*.

The operation of the lock is as follows: The knob *O* serves to turn the index tumbler *G*, which may be considered as the driver, and, by means of the pins connecting operatively the tumblers from top to bottom, they may all be turned together around the standard, as in the act of unlocking. It is designed in this lock, the same as in the aforesaid patented lock, to depend principally upon the sense of touch (but, at times, it may be on hearing as well) to feel or note and count the clicks or tremors of the tumbler key on the index tumbler for ascertaining just how far to turn the knob, in one direction or other, so that a radial notch in each of the tumblers will register with a radial notch of every other tumbler preparatory to the tumbler key falling into said registering radial notches. The cam-plate *C* is positively rotated through its connections,—consisting of the tumbler key and its carrying lever, and the driver tumbler *G* (which, in this case, is also the index tumbler, and is connected by the sleeve *M*, and cross-piece *N*, with the knob *O*), the cam shoulder *c* acting against an incline *j*<sup>3</sup>, on the spring bolt *J* and retracting its catches from the side notches of the hasps, thus releasing the latter and effecting the unlocking. The cap plate of the lock case is fastened on by means of screws, so that it may readily be removed at any time when it is desired to change the combination, or to ascertain just what combination the operating parts are set upon, if the combination should have been forgotten.

Having thus fully described my invention, what I claim is—

1. A sliding bolt provided with a catch for engagement within a notch of a hasp entering the lock, in combination with a cam-plate provided with a tumbler key, and tumblers, and driving mechanism positively engaging one of the tumblers.

2. A sliding bolt provided with catches, and having one of its sides arranged along side the interior of the lock case flange, through apertures which hasps enter to be locked by the bolt catches, the said bolt being provided with a spring to move it in one direction, in combination with a cam plate to move it in the opposite direction, and one or more regular tumblers and an index tumbler.

3. A sliding bolt in combination with a cam-plate carrying a compound lever provided with a tumbler key at one end of a single lever thereof, the other single lever being provided with mechanism for operating it and thereby the lever carrying the key.

4. A sliding bolt, in combination with a cam-plate having a compound lever provided

with a tumbler key, and a switch cam mechanism.

5 5. A two-part tumbler, one part having a pin, and the other part having an annular series of apertures comprised of holes of suitable size for receiving the pin, and a slot like-  
10 wise of suitable size in cross section for receiving the pin and affording a course for the travel of the pin therein in combination with  
15 the driver index tumbler G, and means for operating the same.

6. A driver index tumbler having an elevated peripheral arc portion  $g^5$ , one or more radial notches  $g^3$ , serrations continuing through-  
15 out the periphery excepting the elevated arc-shaped portion, and the part or parts occupied by the radial notches, and having the slots  $g$   
20  $g'$  and  $g^2$ , in its body combined with a bolt, and with means for operating the tumbler.

20 7. The combination with a bolt, and with tumbler operating means, of a serrated index tumbler provided with an elevated peripheral arc-shaped smooth portion, and having one or  
25 more radial notches  $g^3$ , in the remaining portion of the periphery, and provided with slots in its body so located with respect to the radial notch or notches and the serrations that  
30 a corresponding end of each slot would be directly beneath the hollow of a serration or a radial notch or where such depression would be in the elevated smooth arc portion if continued therethrough and the other end of

each of said slots would have a different relation to said peripheral depressions.

8. The driver index tumbler G, secured to 35 the sleeve M, in combination with the cam-plate C, provided with the compound lever D, D', having the key K, and the spring bolt J provided with one or more catches  $j$ .

9. The combination, with a knob, of a spring- 40 pressed sleeve secured thereto, and the upper or driver tumbler connected with said sleeve.

10. A knob and a spring-pressed sleeve connected to an index tumbler, in combination 45 with one or more tumblers.

11. A knob containing within its recessed interior an attaching cross-piece in combina- 50 tion with a sleeve connected with a tumbler.

12. A knob and a sleeve connected to a tumbler, in combination with one or more tum- 50 blers, a tumbler key and mechanism connecting the latter with a sliding bolt.

13. A base plate A provided with a switch cam block  $a$ , two lugs  $a^2$ ,  $a^3$ , and a standard.

14. A base plate having the lugs  $a^2$ ,  $a^3$  each 55 of said lugs having an inner concave surface, and a rim flange provided with one or more openings  $a^5$ .

In testimony whereof I affix my signature in presence of two witnesses.

JAMES D. CRAIG.

Witnesses:

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GEO. C. LOWELL.