(No Model.)

2 Sheets—Sheet 1.

W. W. POWELL.

COMBINATION LOCK.

No. 489,091. Patented Jan. 3, 1893.

Fig. 1.

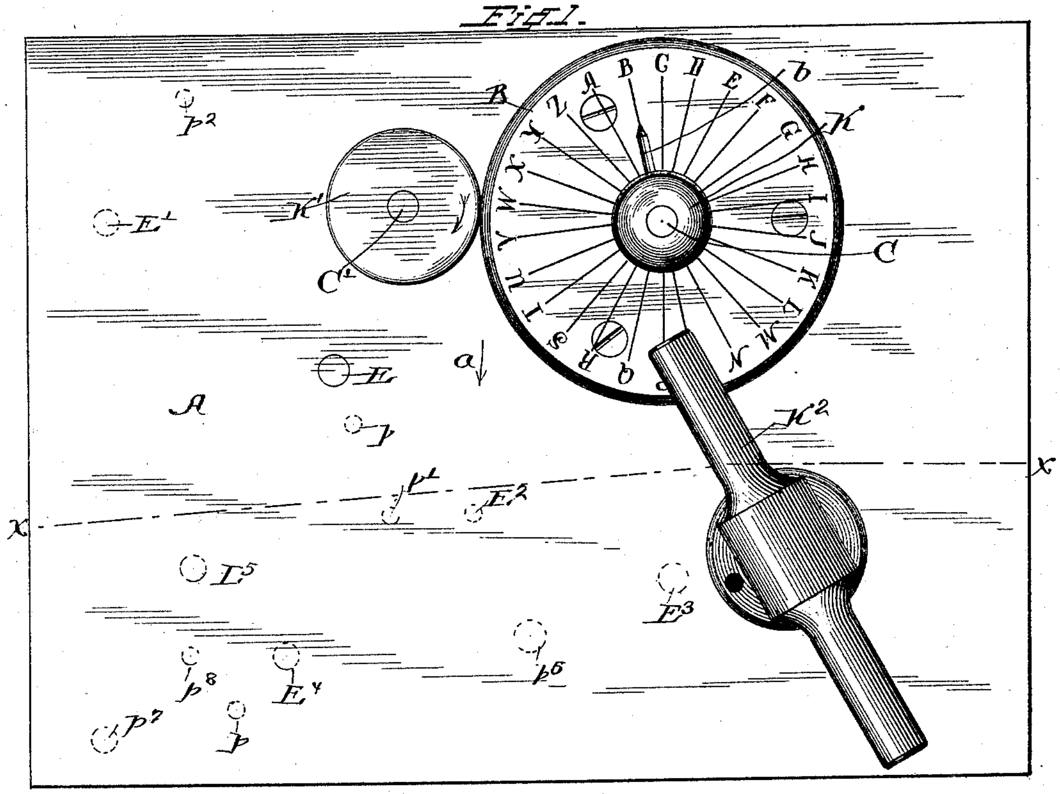


Fig. 2.

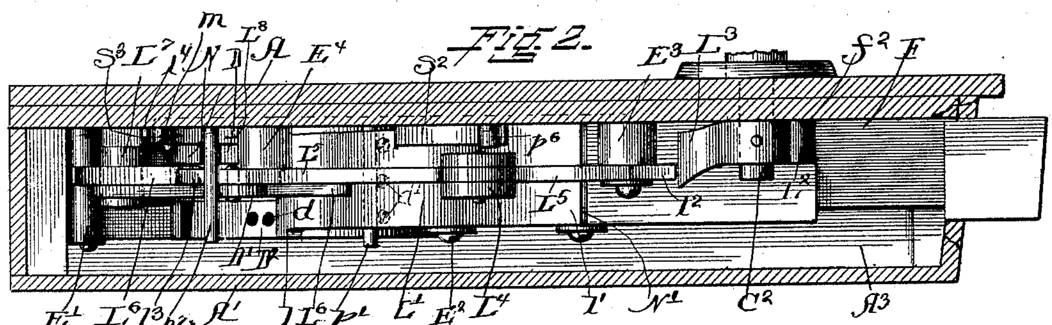
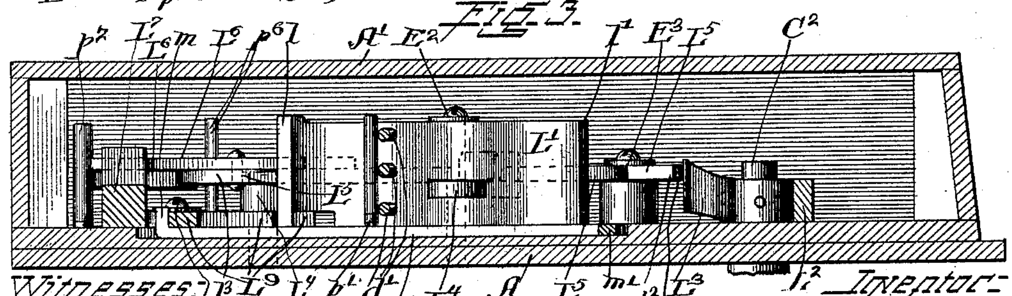


Fig. 3.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

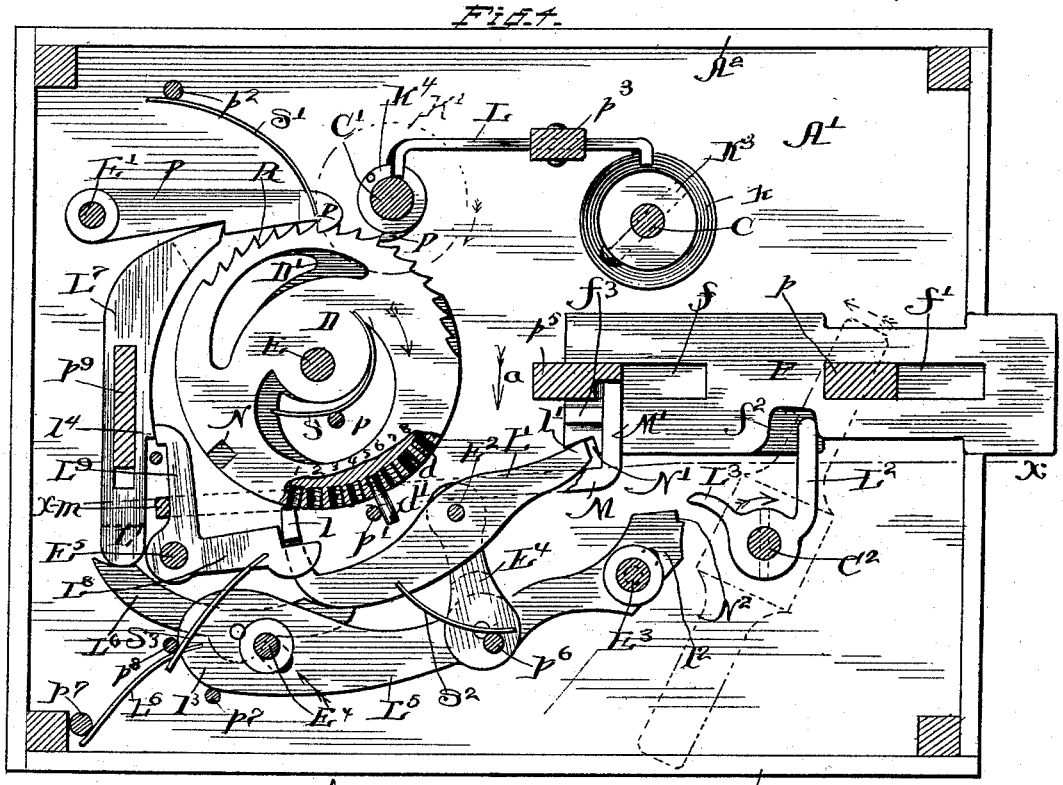
(No Model.) 2 Sheets—Sheet 2.

W. W. POWELL.

COMBINATION LOCK.

No. 489,091. Patented Jan. 3, 1893.

Fig. 4.



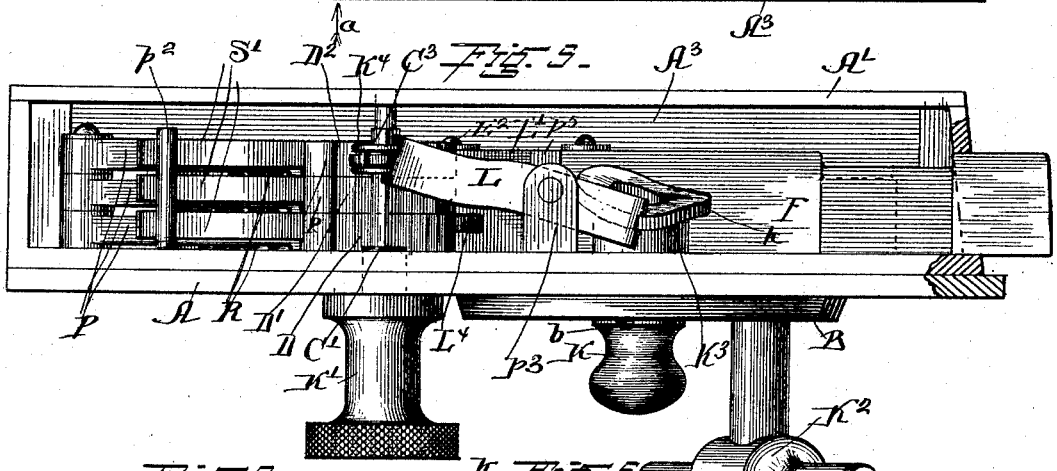


Fig. 5.

Fig. 7.

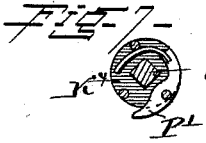
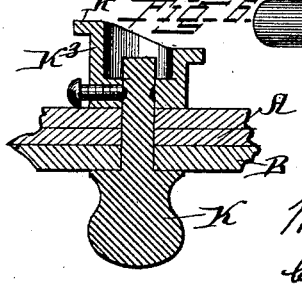


Fig. 6.



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UNITED STATES PATENT OFFICE.

WINSLOW W. POWELL, OF FREEPORT, ILLINOIS, ASSIGNOR OF ONE-HALF TO ADOLPH BRANDT, OF SAME PLACE.

COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 489,091, dated January 3, 1893.

Application filed March 28, 1892. Serial No. 426,686. (No model.)

To all whom it may concern:

Be it known that I, WINSLOW W. POWELL, a citizen of the United States of America, residing at Freeport, in the county of Stephenson and State of Illinois, have invented certain new and useful Improvements in Combination-Locks, of which the following is a specification.

My invention relates to improvements in combination locks, its object being to provide a lock of simple construction not liable to get out of order, easily and quickly operated by any person knowing the combination on which it is set, and at the same time extremely difficult, if not impossible, to open by any person not knowing the combination.

The invention is fully described and explained in this specification and shown in the accompanying drawings, in which

Figure 1 is a front elevation of the case of a lock embodying my invention, the parts upon the front of the case being shown, and various posts which support the mechanism within the case being indicated in dotted lines; Fig. 2 is a bottom plan of the lock, the lower rim of the case being removed; Fig. 3 is a transverse section of the lock through the line x—x, Figs. 1 and 4, the view being in the direction indicated by the arrows, a, a, in said figures; Fig. 4 is a front elevation of all the internal working parts of the lock, the front wall of the case being removed; Fig. 5 is a top plan of the interior of the lock, the upper rim being removed; Fig. 6 is a central section of the knob, K, and the cam operated thereby; Fig. 7 is a detail view of the pawl and pawl-carrying device which operates the combination disks of the lock.

In the views, A is the front plate; A′ is the back plate; and A^2 A^3 are the upper and lower rims, respectively, of the case of my improved lock. On the front face of the wall, A, is secured a stationary plate, B, having on its margin a series of letters or other characters whose object is hereinafter set forth, and three knobs K, K′, K^2, lie outside the front wall and are rigidly mounted respectively on spindles, C, C′, C^2, passing through the wall and into the interior of the case, the knob K, being at the center of the plate B, and being provided with an indicating pointer, b, adapted to accurately indicate the position of the knob and the part within the case operated thereby. The spindles C, C′, C^2, are the only rotating arbors of the lock, and these spindles and the parts within the lock mounted upon them are the only elements operated directly from the outside. All the other movable parts of the lock are supported by non-rotating stationary posts set in the front wall of the case and projecting inward therefrom, the back wall being nearly a cover which may be removed without changing the position of any of the working parts of the lock or their supports.

Within the case and near the rear end thereof are three similar circular disks D, D′, D^2, mounted and rotating freely upon a post E. Each of the disks has in one part of its margin a series of ratchet teeth, R, and three pawls P, P, P, Figs. 4 and 5, so placed as to engage the teeth of the respective ratchet wheels, are provided with springs S′, S′, S′, resting against a pin p^2 and tending to hold the pawls in engagement with the ratchet teeth of the disks. In that part of the margin of each of the disks opposite the ratchet teeth, are formed a series of radial screw holes d, Fig. 4, and each of the disks is provided with a screw d', adapted to be set in any one of said screw holes. Each of the disks is provided with a spring, S, and all three of these springs press against a pin, p, lying near the common center of the disks and tending to rotate the disks in the direction indicated by the arrow on the disk D, Fig. 4, and thereby to hold the marginal screws d', of the three disks in contact with a pin p', lying just outside the margin of the disks and forming a stop to limit their rotation.

On the inner end of the spindle C, is adjustably mounted a cam K^3, Figs. 4, 5 and 6, having a projecting rim, k, which lies in a notch in one end of a horizontally oscillating lever L, pivoted in a post p^3, the cam being susceptible of rotation by means of the external knob K, and its rotation being adapted to move the end of the lever with which it engages toward or away from the front plate A, of the case. The opposite end of the lever L, is also notched and embraces the edge of a pawl-supporting disk K^4, which slides freely upon a square extension or continuation C^3,

of the spindle C′, as is clearly shown in Figs. 5 and 7. The oscillation of the lever L, by means of the rotation of the cam K^3, moves the pawl-supporting disk K^4 toward or away from the front plate of the case, and by means of this movement, the disk may be brought successively into the planes of the three disks D, D′, D^2. On the disk K^4 is pivoted a pawl, P′, provided with a spring adapted to press its point outward and hold it normally in a position to engage the ratchet teeth of either one of the disks D, D′, D^2, in whose plane it may be, and it is evident that if the pawl P′, be in position to engage the ratchet teeth of any one of the disks D, D′, D^2, the rotation of the knob K′ in the direction indicated by the arrow on its face in Fig. 1, or on the circumference of the corresponding dotted circle in Fig. 4, must rotate the disk step by step, one tooth for each rotation of the knob, and that the toothed disk must be secured against reverse rotation through the engagement of the corresponding pawl P. In this way, the pawl P′, may be made to actuate the disks D, D′, D^2, successively, and each of them may be moved through any desired angular space by a corresponding number of rotations of the knob, K′, and pawl P′. Since the pawl P′, is pivoted and pressed outward by the spring upon the disk K^4, its point resists pressure in one direction, but yields readily to pressure in the opposite direction, and in operating the disks D, D′, D^2, by means of the pawl P′, it is, therefore, only necessary to partially rotate the pawl-bearing disk K^4 at each impulse given to the toothed disk, the motion of the pawl being reversed each time as soon as it has moved the ratchet wheel forward sufficiently to bring a new tooth into engagement with the corresponding pawl P. It is evident that as the rotation of the knob K, changes the position of the pawl-carrying disk K^4, it is only necessary to know accurately the position of the knob and of the cam which moves with it in order to know the position of the pawl-carrying disk with reference to the disks D, D′, D^2. It is for this purpose that the knob K, is provided with the pointer *b*, it being only necessary to know the positions of the pointer on the dial corresponding to the various positions of the pawl-carrying disk in order to intelligently control the movement of the disk and bring it into position to operate any one of the disks, D, D′, D^2. This being the case, it is evident that only three of the letters on the plate B, can be of use in any given relation of the parts of the lock, but by means of the adjustment illustrated in Fig. 6, the cam K^3, may be turned to any desired position, and the letters on the plate B, indicating the necessary positions of the pointer, *b*, may thereby be changed at will.

In the end of the case opposite the disks D, D′, D^2, is a longitudinally sliding bolt F, adapted to be projected through the end wall of the case, as shown in Figs. 2, 4, and 5, or to be retracted until its outer end is flush with the outer surface of the end wall. The bolt is held in place by two posts p^4, p^5, which lie in slots *f*, *f*′, in the bolt, and it has in its lower margin a recess f^2, Figs. 2, 4, which receives the end of one of the arms L^2, of a lever mounted on the arbor C^2, and rotated by means of the handle K^2, outside the case, the other arm L^3, of the lever being used in a manner hereinafter explained. In the rear end of the bolt F, is a notch N′, in which lies the end *l*′, of a lever L′, pivoted on a stationary post E^2, Fig. 4, the opposite end *l*, of the lever being turned inward in a plane approximately radial to the disks D, D′, D^2, and the edge of the end so turned in being of such horizontal width as to impinge upon the margins of all three of the disks. Each of the disks D, D′, D^2, is formed with a notch N, Fig. 4, all these notches being placed in the same relation to the ratchet teeth and screw holes of their respective disks, and each of the notches being of such extent as to admit the end *l*, of the lever L′. If, therefore, all the notches N, be brought into such positions as to register with each other and with the end *l*, of the lever, the latter may enter the notches, thereby throwing the opposite end *l*′, of the lever out of the notch N′, in the bolt F, and permitting the retraction of the bolt. A spring S^2, set in the face of the lever, L′, presses against a post, p^6, and tends to draw the end *l*, of the lever away from the margins of the disks and prevent it from entering the notches in the margins thereof unless pressed toward them in the manner hereinafter explained. In order to bring the notch N, of any one of the disks D, D′, D^2, into position to be entered by the end *l*, of the lever L′, it is evidently necessary to rotate the disk in a direction opposite to that indicated by the arrow on the face of the disk D, in Fig. 4, and the angular space through which the disk must be turned in order to bring the notch to the desired position, depends upon the position of the screw *d*′, in the margin of the disk. As has been said before, each of the disks is formed with a series of marginal screw holes *d*, and in Fig. 4 I have designated these screw holes in the disk D, by the figures, 1, 2, 3, 4, 5, 6, 7, and 8, respectively, the screw holes in the other disks being of the same number and in the same relative positions. As shown in Fig. 4 the screw *d*′, is set in the screw hole indicated by the figure 5, and the notch N, is so placed that in order to bring it opposite the end *l*, of the lever, the screw *d*′, must be moved away from the post *p*′, a distance equal to four of the ratchet teeth upon the opposite arc of the margin of the disk. This movement of the screw away from the post *p*′, requires a rotation of the disk such as can be produced by four rotations of the pawl-bearing disk K^4, and of the knob, K′, by means of which it may be operated. If the screw *d*′, were set in the screw hole indicated by the figure 8, it would require seven

rotations of the knob K′, and disk K⁴, to impart the necessary rotation to the disk D, and on the other hand, if the screw were set in the screw hole designated by the figure 1, the notch N, would lie opposite the end of the lever L′, when the screw was in contact with the post, p', and therefore no movement of the disk would be required to bring the notch of the disk D, into position to receive the end of the lever. It is evident, therefore, that the position of the screw d', in each disk determines the number of step by step movements which must be given to that disk in order to bring its notch N, into position to receive the end, l, of the lever L′. This being the case, it is only necessary to know the positions of the screws d', in the margins of their respective disks in order to know how many turns must be given to the disk K⁴, in each of the positions to which it is successively brought by the rotation of the knob, K, and cam K³. These things being known, it is a very simple matter to bring the notches N, of the three disks D, D′, D², into position for retracting the bolt, since the rotation of the knob, K, will bring the pawl-bearing disk K⁴, successively into the planes of the three disks, D, D′, D², and a suitable number of turns of the pawl-bearing disk while in each position will bring all the notches N, into registration with the end, l, of the lever, L′. On the post E², at the center of the lever L′, is pivoted the upper end of a dependent link L⁴, whose lower end is pivoted to the center of a lever L⁵, having a combined swinging and sliding movement, the lever being formed with slots near its ends which embrace respectively two posts, E³, E⁴. The end l^2, of the lever L⁵, lies near the end of the arm L³, of the lever on the shaft C², and when the lever L², L³, is rotated toward the lever L⁵, the end of the arm L³, enters a notch N², in the end thereof and moves the lever L⁵, away from the shaft C². The slots in the lever L⁵ are of such form and are so placed that this movement of the lever gives to its end l^3, a movement in the direction indicated by the arrow thereon in Fig. 4. To this end of the lever is pivoted another lever L⁶, one of whose ends rests against the lever L′, while the other end rests against the lower end of a vertical dog L⁷, sliding upon a post p^9, the upper end of the dog being in contact with the lower magins of all the pawls P, P, P. When the rotation of the handle, K², and shaft C² brings the end of the arm L³ into the notch N², the further rotation of the shaft pushes the lever L⁵, away from the shaft and gives to the opposite end L³, thereof the motion indicated by the arrow thereon in Fig. 4, thus pressing the lever L⁶, upward against the sliding dog L⁷, and the end l, of the lever L′. If the disks D, D′, D², be in the position shown in Fig. 4, the end l, of the lever L′, cannot enter the notches N, of the disks and it, therefore, remains stationary. The upward pressure of the lever L⁶, being thus brought to bear upon the dog L⁷, the latter is pressed upward and lifts the pawls P, P, P, out of engagement with the notches in the disks. As soon as the dog is thus raised, the end L⁹, of a bell crank lever mounted on a post E⁵, drops in beneath a shoulder l^4, on the dog and holds it in its raised position, thereby supporting the pawls P, P, P, and keeping them out of engagement with the disks. The arm L⁹, of the bell crank lever is constantly pressed toward the dog L′, by means of a spring S³, set in the other arm L⁸, and pressing against a post p^8. On the other hand, if the disks D, D′, D², are in such position that the three notches N, N, N, register with the end l, of the lever L′, the upward pressure of the lever L⁶, against the lever L′, and the dog L⁷, presses the end l, of the lever into the notches N, N, N, since the resistance of the spring of the lever L′, is less than that of the three springs upon the pawls P, P, P, all of which tend to hold the pawls in engagement with the disks, and thereby to hold the dog in its lowest position. As soon as the end l, of the lever L′, enters the notches N, N, N, the opposite end l', of the lever drops down out of engagement with the notch N′, in the bolt F, and upon the further rotation of the handle K², and lever L², L³, in the same direction, the upward pressure of the lever L⁶, upon the dog L⁷, raises the latter and locks the pawls P, P, P, out of engagement with the disks in the manner already described. A still further rotation of the handle K², and lever L², L³, swings the point of the arm L³, out of the notch N², and the arm L², presses the bolt F, inward until it is fully retracted and its outer end lies within the outer surface of the case. In this position of the lock the bolt is retracted, the end l, of the lever L′, lies in the notches N, of the disks D, D′, D², and all the pawls P, P, P, are held out of engagement by the dog L⁷, which in turn is supported by the end of the arm L⁹, of the bell crank lever which lies under the shoulder l^4, on the dog.

In a groove in the inner face of the front plate, A, of the case lies a longitudinally sliding connection rod M, Figs. 3, 4, one end of which is provided with a horizontal extension m, lying behind the arm L⁹, of the bell crank lever, while the other end is provided with a vertical extension m', lying in front of the inner end of the bolt F. The bolt is provided with a lug f^3, lying in a groove in the front plate and engaging the extension m', of the connecting rod when the bolt is fully extended, the connecting rod being of such length that when the bolt is pressed outward to the position shown in Fig. 4, the extension m, of the connecting rod draws the arm L⁹, of the bell crank lever out of engagement with the dog. If, now, the parts be in the relative positions set forth at the end of the last paragraph, the rotation of the handle and of the lever L², L³, in the direction indicated by the arrow on the lever in Fig. 4, must throw the bolt outward. When this movement of the bolt brings the notch N′, opposite the end l', of the lever L′,

the opposite end *l*, of the lever must be released from the notches N, in the disks D, D′, D², and the disks being thus freed from the lever and being out of engagement with the pawls P, P, P, they must immediately rotate under the influence of the springs S, S, S, until the screws *d*′, in their margins strike the post *p*′, when they will be in the positions indicated in Fig. 4. It will be observed that the notch N′, in the bolt F, is of such extent as to leave an open space between its front wall and the end of the lever L′, when the bolt is fully extended, and, consequently, after the end *l*′, of the lever has dropped into the notch, the bolt has still a slight outward movement. At the instant that the end of the lever L′, drops into the notch N′, the lug f^3, on the bolt strikes the extension *m*′, of the connecting rod, and during the further outward movement of the bolt the lug presses the connecting rod outward, thereby drawing the arm L^9, of the bell crank lever out of engagement with the dog L^7, and permitting the latter to drop downward and bring the pawls P, P, P, again into engagement with the teeth of the disks, D, D′, D². The parts of the lock are now in the position indicated in Fig. 4, and the bolt can only be retracted by again working the combination of the disks, bringing the notches N, opposite the end *l*, of the lever L′ and throwing back the bolt in the manner already described.

It has already been explained that if the end of the lever L^8, be pressed against the end of the lever L^5, when the notches N, N, N, are not all in position to receive the end *l* of the lever L′, the dog L^7, will be pressed upward and locked by the arm L^9, thereby holding the pawls P, P, P, out of engagement with the notches of the disks, D, D′, D². This is of great importance since any person attempting to retract the bolt after partially working the combination must not only fail to move the bolt, but must also throw the pawls out of engagement with the disks and thereby cause all the disks to rotate back to their original positions thus making it necessary to begin anew the working of the combination.

The operation of my improved lock is sufficiently apparent from the foregoing explanation, and I think, it will be seen that even with the limited number of combinations possible in the construction shown in the drawings, the opening of the lock by a person not knowing the combination to which the lock was set, would be extremely difficult. Since the number of notches on each of the disks and the number of marginal screw holes may be increased as desired, and since the number of disks may also be increased, it is evident that the number of possible combinations may be made so great as to render it practically impossible to work them all within any reasonable length of time, and the lock may thus, as I believe, be so constructed, as to be practically proof against operation by any person not knowing the combination on which it is set.

Having now described my invention and explained its operation, what I claim as new and desire to secure by Letters Patent is:

1. In a lock of the class described, the combination with a bolt, a locking lever adapted to prevent the retraction thereof when in one position, and a series of rotating disks notched to admit the end of the lever and formed with ratchet teeth in their margins, of a pawl adapted to engage the teeth on said disks, and means, substantially as shown and described for adjusting said pawl to bring it successively into the planes of the disks whereby the same pawl may in turn rotate all of said disks and bring the notches therein opposite the end of the lever; substantially as shown and described.

2. The combination with the bolt F, the disks D, D′, D², formed with marginal ratchet teeth and a marginal notch N, and the lever L′, adapted to lock the bolt F, and having an end *l*, adapted to enter the notches N, of the adjustable pawl P′, adapted to engage the teeth of the disks, and means, substantially as shown and described, for bringing it successively into the planes of the three disks whereby its rotation in its different positions may rotate the disks and bring all the notches N, opposite the end of the lever L′; substantially as shown and described.

3. The combination with the bolt F, the lever L′, and the disks D, D′, D², formed with notches N, and ratchet teeth, of the sliding pawl P′, adapted to be brought successively into the planes of the disks, the lever L, engaging said pawl or its support, and means, substantially as shown and described, for operating said lever from the exterior of the lock and bringing the lock successively into the planes of the disks; substantially as shown and described.

4. The combination with the bolt F, the lever L′, the disks D, D′, D², the pawl P′, and its support, and the lever L, of the cam K^3, engaging the end of the lever L, the shaft C, the knob K, mounted on the shaft, and means, substantially as shown and described, whereby the position of the knob may indicate the position of the pawl P′, with reference to the disks D, D′, D².

5. The combination with the bolt F, the lever L′, and the toothed disks D, D′, D², formed with notches N, adapted to receive the end of the lever, and also formed with marginal screw holes *d*, of the screws, *d*′, adapted to be adjustably secured in the screw holes in the margins of the disks, and the pin *p*′, adapted to serve as a stop for the screws and as a limit to the rotation of the disks; substantially as shown and described.

6. The combination with the bolt, the locking lever, the toothed disks, and means for rotating the same, of the pawls P, P, P, engaging the teeth on the disks, respectively,

and means, substantially as shown and described, for locking the pawls out of engagement with the disks; substantially as shown and described.

7. In a lock of the class described, the combination with a suitable case, of a sliding bolt, a locking lever adapted to prevent retraction of the bolt when in one position, a series of disks formed with ratchet teeth, and also with notches adapted to admit the end of the locking lever to permit retraction of the bolt, and means for imparting step by step rotation to the disks and thereby bringing the notches opposite the end of the locking lever, a series of pawls engaging the teeth of the disks and preventing reverse rotation thereof, a lever operated by means outside the lock case and adapted to retract the bolt and means, substantially as shown and described, interposed between said lever and said pawls whereby the rotation of the lever to retract the bolt when the notches in the disks are not in position to admit the end of the locking lever throws the pawls out of engagement with the disks and thereby permits reverse rotation thereof; substantially as shown and described.

8. The combination with the bolt, the disks D, D′, D^2, and the locking lever L′, of the pawls P, P, P, engaging the disks respectively, the sliding dog L^7, adapted to throw the pawls out of engagement with the disks, the lever L^2, L^3, operated from the exterior of the lock and means, substantially as shown and described, interposed between the arm L^3 of the lever and the dog L^7, whereby suitable rotation of said arm raises the dog and locks the pawls P, P, P, out of engagement with the disks; substantially as shown and described.

9. The combination with the disks D, D′, D^2, the pawls P, P, P, the dog L^7, and the lever L^9, of the bolt F, provided with the lug f^3, and a connecting rod M, formed at its ends with extensions engaging said lug and the lever L^9 respectively, whereby the complete extension of the bolt draws the lever L^9 from engagement with the dog, substantially as described.

10. The combination with the disks, the bolt and the locking lever L′, of the pawls P, P, P, the dog L^7, and lever L^9, the sliding lever L^5, and the lever L^6, interposed between said sliding lever and the lever L′, and dog, L^7, and the lever L^2, L^3, adapted by its rotation to operate the bolt, and also to operate the lever L^5, and through it the lever L′, the dog L^7, and the pawls P, P, P, substantially as shown and described

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