

B. H. ZIEHLER.
PERMUTATION LOCK.
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1.048,262.

Patented Dec. 24, 1912.

2 SHEETS-SHEET 1.

Fig. 1

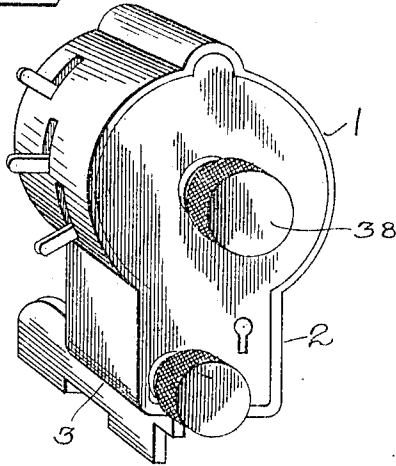


Fig. 2.

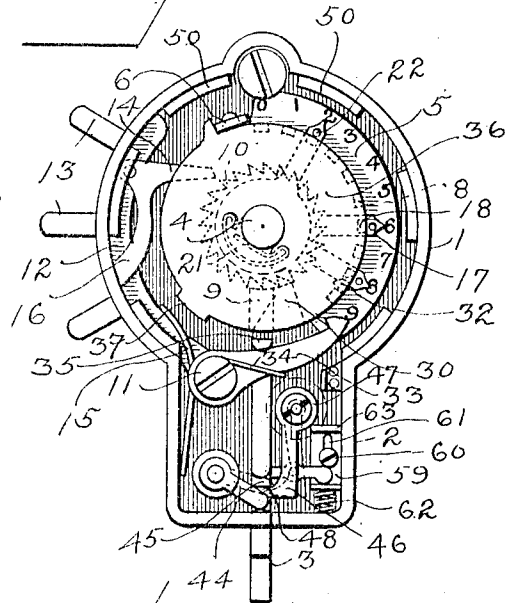


Fig. 3

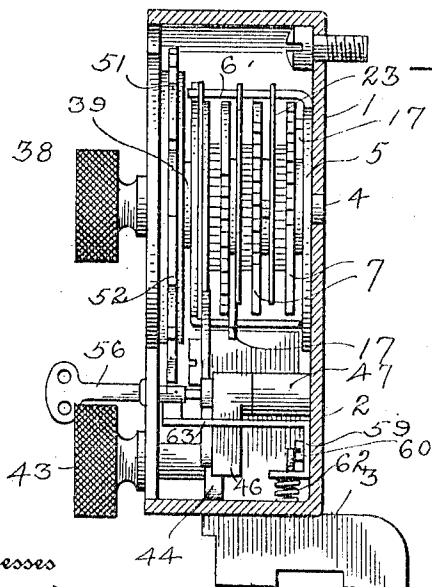
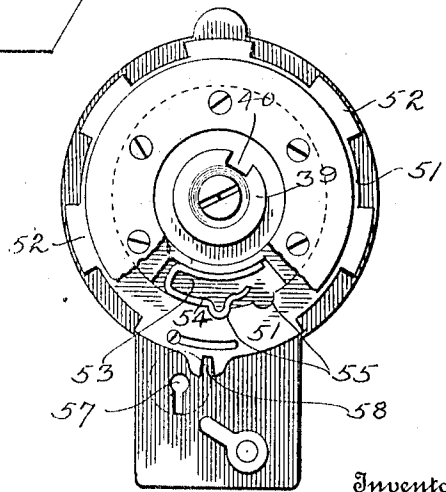


Fig. 4.



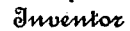
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1,048,262.

2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

BERNARD H. ZIEHLER, OF DAYTON, OHIO.

PERMUTATION-LOCK.

1,048,262.

Specification of Letters Patent.

Patented Dec. 24, 1912.

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To all whom it may concern:

Be it known that I, BERNARD H. ZIEHLER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Permutation-Locks, of which the following is a specification.

My invention relates to locks and particularly to permutation or combination locks used for locking doors, chests or other similar purposes, but especially adapted for locking against movement any movable member such as the control lever of an automobile or other machine.

The object of the invention is to simplify the structure as well as the means and mode of operation of such devices whereby they will not only be cheapened in construction but will be more efficient in use, positive in action, easily and readily adjusted and unlikely to get out of repair.

Further objects of the invention are to provide simple and convenient means for quickly changing the combination of the permutation lock and to provide locking means for the lid or closure whereby access may be had to the operating parts only by the proper working of the combination.

A further object of the invention is to provide means for positively securing the locking bolt in its locked position, independent of the permutation or combination members.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof and the mode of operation or their equivalents as hereinafter described and set forth in the claims.

Referring to the drawings, Figure 1 is a perspective view of the permutation lock forming the subject matter hereof. Fig. 2 is a front elevation of the lock with the cover of the housing removed. Fig. 3 is a side elevation of the assembled lock with one wall of the closure broken away to disclose the operating mechanism within. Fig. 4 is an elevation of the inner side of the cover or closure for the housing with parts broken away. Fig. 5 is a detailed perspective view

of the indicator disk and stop for the several combination disks. Fig. 6 is a detailed view of one of the combination disks and operating mechanism therefor. Fig. 7 is a reversed view of one of the combination disks showing the adjustable stop arm therefor. Figs. 8, 9 and 10 illustrate the step up mechanism whereby the locking parts are automatically operated upon the movement of the bolt from unlocked to locked position. Fig. 8 illustrates the relative position of the parts when the combination disks have been operated to unlocked position but before the locking bolt has been shifted. Fig. 9 is a similar view illustrating the position of the parts after the locking bolt has been shifted. Fig. 10 is a similar view illustrating the relation of the parts after the locking bolt has been returned from unlocked to locked position and one of the combination disks automatically advanced to lock the bolt in its operated position. Fig. 11 is a detailed perspective view of the resetting disk. Fig. 12 is a detailed perspective view of the bolt shifting mechanism together with the positive locking device therefor and the key locking mechanism controlled by the movement of the bolt. Fig. 13 is a perspective view of one of the spacer disks. Fig. 14 is a detail view of the locking bolt.

Like parts are indicated by similar characters of reference throughout the several views.

In constructing the device there is employed a casing or housing comprising an annular portion from which projects a rectangular offset portion 2. Located within the annular portion 1 are a plurality of combination disks independently revoluble therein controlling the movement of a locking bolt 3 reciprocating in and projecting beyond the rectangular offset portion 2 of the housing. Centrally disposed within the annular portion of the housing 1 is the main shaft 4. Stationarily secured within the housing and adjacent to the inner wall thereof is the indicator disk 5, shown in detail in Fig. 5 carrying a stop post 6 projecting perpendicular to said indicator disk 5 and preferably formed integral therewith. The indicator disk 5 carries adjacent to its periphery a series of figures or characters by which the stop levers of the combination

disks hereinafter mentioned may be adjusted to various relative positions. Each of the combination or permutation members comprises a disk 7 revolvably mounted upon the main shaft 4 and having formed in its periphery a series of notches or recesses 8 corresponding to the figures or characters upon the indicator disk 5. There is also in each of the combination disks 7 a deep notch or recess 9 within which the locking bolt will reciprocate when the several combination disks are in unlocked position. Any number of such combination disks may be employed but it is found that three such disks provide the preferable combination. Secured to one side of each of the revoluble combination disks 7 is a ratchet pinion 10 by which the disk may be rotated upon the main shaft 4.

Pivotaly located upon a suitable stud 11 adjacent to the series of combination disks 7 are a plurality of operating levers 12, one such operating lever for each of the combination disks 7. Each of the operating levers 12 is provided with an arm 13 projecting through a suitable opening in the side wall of the housing and in such relation with each other that the several operating levers 12 may be independently operated upon their pivotal connection with the stud 11. Each of the operating levers 12 carries a pawl arm 14 adapted to engage the ratchet pinion of the corresponding disk 7 upon the inward operation of the operating lever 12 and thereby rotates the ratchet pinion 10 and its connected combination disk 7 through an advanced movement of one step. Retracting springs 15 are provided for each of the operating levers adapted to return the levers after each operation whereby the operating pawl 14 will be withdrawn entirely from engagement with the ratchet pinion 10 thereby permitting the pinion to be rotated in reversed direction to reset the disk as hereinafter mentioned. The pawl arms 14 may be of any suitable shape or design, those shown in the drawing being provided with pendant arms 16 which engage the wall of the housing when the operating levers 12 are in normal position to maintain the pawl arms in position to engage the ratchet pinions 10 upon the oscillation of the operating levers. Located upon the opposite side of each of the combination disks 7 is an adjustable stop arm 17 which is movable in a radial direction and then to different radial positions in relation to the main shaft 4. Each of said adjustable stop arms is provided with a lug or projection 18 adapted to engage in any one of the series of notches or recesses 8 in the periphery of the combination disk 7. Each of the stop arms 17 comprises a disk shaped head portion eccentric with the main shaft 1 from which the arm projects in a radial direction. Each of

the stop arms is provided with an aperture 19 within a portion of which the main shaft 4 engages. There is also located in the aperture 19 of each of the stop arms a spring 21 engaging the wall of the aperture and also engaging the main shaft 4 as clearly shown in Fig. 7. This spring 21 tends to move the stop arm radially toward the main shaft 4 thereby maintaining the lug 18 in engagement with the notch or recess 8 in the periphery of the combination disk 7. The engagement of the lug 18 within the notch 8 prevents the revoluble movement of the stop arm from the adjusted radial position. There is provided in each of the stop arms 17 adjacent to its outward extremity an opening 22 in which may be engaged a pointed instrument by which the stop arm may be pulled outward in a radial direction against the tension of the spring 21 to disengage the lug 18 from the notch 8 in the periphery of the disk whereupon the stop arm may be rotated about the main shaft 4 to adjust the stop arm to different radial positions enabling the lug 18 to be engaged in any one of the notches or recesses 8. By this adjustment of the several stop arms to different radial positions the series of operations necessary to move the several disks to unlocked position may be varied. It is to be understood that several of the combination disks 7 together with their corresponding ratchet pinions 10 and stop levers 17 are mounted side by side upon the main shaft 4 but that each of said combination disks with its corresponding pinion and stop lever is independently rotatable upon said shaft. In order that the rotation of one of the combination disks may not interfere with or effect the rotation of the next succeeding disk there is interposed between successive disks a spacer member or washer 23 comprising a plain disk mounted upon the main shaft 4 having a projecting lug or finger 24 engaging with the stop post 6. In the drawing the stop post 6 is shown as provided with a central slot or opening 25 in which the fingers 24 of the spacer members 23 engage. It is obvious however that the spacer members may be provided with two separated lugs or fingers similar to the finger 24 which separated fingers would engage on opposite sides of the stop post 6 or said spacer members might be secured upon the main shaft 4 or stationarily held thereon by any other suitable means.

In order to automatically lock the bolt in its operated position without the necessity of manually adjusting the several combination disks there is provided means for automatically advancing one of the combination disks a predetermined step at each operation of the bolt thereby necessitating the resetting of the combination disks to unlocked position before the bolt can be

again operated. This construction is best shown in Figs. 8, 9 and 10. There is loosely journaled upon the main shaft 4 besides one of the combination disks 7 an advance disk 26 having therein a concentric slot or aperture 27. Located within the slot or aperture 27 is a spring 28 one end of which engages in the combination disk 7 or its corresponding ratchet pinion 10 while the opposite end of the spring 28 engages in the advance disk as at 29. The advance disk 26 is also provided with a notch or recess 30 corresponding to the recess 9 of the combination disk 7. One side of the notch or recess 30 is beveled as at 31 to form a cam face adapted to be engaged by the extremity of the locking bolt upon its inward movement to rotate the advance disk 26 against the tension of its spring 28. There is also provided in the periphery of the advance disk 26 a notch 32 adapted to be engaged by a hook arm 33 pivotally supported upon the stud 11 and is spring pressed toward the advance disk 26 by a spring 34. In Fig. 8 the several parts are shown in unlocked position, that is with the several combination disks adjusted to bring the notch or recess 9 of each disk into registry with the locking bolt 3, but that locking bolt 3 has not been shifted inward or upward to its unlocked position. It will be noticed by reference to Fig. 8 that while the notches or recesses 9 of the several combination disks 7 register with the extremity of the locking board 3, the notch or recess 30 of the advance disk is offset or out of alinement with the extremity of the locking bolt. As the locking bolt 3 is moved inward by manually operated means hereinafter mentioned, it enters the notches or recesses of the several combination disks 7 and also engages the inclined cam face 31 of the notch 30 in the advance disk 26. By the inward movement of the locking bolt 3 while in engagement with the inclined face 31 of the notch 30, the said disk 26 is rotated to bring the notch 30 into registry with the notches 9 of the several combination disks 7. This rotation of the advance disk 26 is against the tension of the spring 28 placing such spring under stress. The rotation of the advance disk 26 due to the action of the locking bolt 3 upon the inclined cam face 31 brings the notch 32 in the periphery of said disk into registry with the hook arm 33 whereupon the said hook arm 33 engages in said notch 32 under the influence of the spring 34 to retain the advance disk 26 in its adjusted position. The spring 28 engaging at one extremity the advance disk 26 and at its opposite end the adjacent combination disk 7 or its ratchet pinion 10 being placed under tension by the rotation of the advance disk 26 tends to rotate said disks in opposite directions upon the main shaft 4.

However the hook arm 33 engaging in the notch 32 prevents the return rotation of the advance disk 26 while the locking bolt 3 engaging in the notches or recesses 9 of the several combination disks 7 prevents a movement of said combination disks until the locking bolt is withdrawn therefrom. However upon the shifting movement of the locking bolt 3 from its unlocked or inner position toward its locked or operated position withdraws said bolt from within the notches or recesses 9 of the combination disks and immediately thereupon and before the locking bolt has effected the release of the hook arm 33 from the notch 32 the spring 28 acts to advance the combination disk 7 to which it is attached a distance of one step as is clearly shown in Fig. 10. This effectually prevents a return movement of the locking bolt 3 until the combination disks are again rotated to bring the several notches or recesses 9 into registry. The locking bolt 3 is provided with a projecting shoulder 35 at its upper extremity which shoulder engages with the hook arm 33 as the locking bolt is advanced into its locked or operated position and thereby withdraws the hook arm from its engagement with the notch 32 of the advance disk 26 against the tension of the spring 34. When the hook arm 33 is so disengaged the disks are free to be reset to normal or zero position. To recapitulate the automatic locking mechanism illustrated in Figs. 8, 9 and 10 is such that the independent operation of the several combination disks 7 brings the notches or recesses 9 thereof into registry with each other and also into registry with the extremity of the locking bolt 3. This adjustment of the combination disks 7 also adjusts the advance disk 26 to bring the inclined face 31 into the path of the locking bolt 3. The engagement of the locking bolt 3 with the inclined face 31 rotates the advance disk 26 upon the main shaft 4 thereby placing the spring 28 under tension. The hook arm 33 under the influence of the spring 34 engages in the notch 32 in the periphery of the advance disk 26 thereby retaining said disk 26 in its operated position and the spring 28 under tension. Upon the disengagement of the locking bolt 3 from the notches or recesses 9 of the combination disks 7 and before the shoulder 35 has engaged the hook arm 33 the combination disks being released by the withdrawal of the locking bolt 3 the spring 28 acts to advance the combination disk to which it is attached through a predetermined step thereby moving the notch or recess 9 of that particular combination disk out of registry with the remaining notches or recesses 9 and out of registry with the locking bolt 3 whereby said bolt will be prevented from returning to its unlocked position. The further movement of

the locking bolt thereupon withdraws the hook arm 33 and permits the several disks to be returned to normal.

To return the several disks to normal position there is provided a resetting disk 36 loosely journaled on the main shaft 4 and provided with the arm 37 extended perpendicular to the plane of the said disk 36 and across the peripheries of the several combination disks as shown in Fig. 3. The resetting disk is adapted to be rotated upon the main shaft 4 by means of a manually operated knob or stem 38 upon the exterior of the cover or closure of the housing 1, said knob carrying at its inner side of the closure a head 39 having therein a recess or notch 40 within which engages a lug 41 upon the resetting disk 37. As the knob or stem is rotated the resetting disk 36 is revolved in unison therewith and its arm 37 extending across the periphery of the several combination disks 7 engages with the projecting stop arms 17 thereby rotating the several disks until the stop arms 17 thereof are brought into registry with each other and into engagement with the stop post 6 by which the rotary movement is limited. The resetting disk 36 is then rotated in the opposite direction to move the arms 37 out of the path of the several stop arms 17, the movement of the resetting disk in the opposite direction being limited by the engagement of the lug 42 thereof with the opposite side of the stop post 6. Carried upon the lower portion of the lid or closure of the housing is a second revoluble knob or handle 43 carrying upon its shaft a rock arm 44. The rock arm 44 engages in a notch or recess 45 in the reciprocating locking bolt 3 whereby said bolt is shifted to and from its locked position by the partial rotation of the knob or handle 43. To prevent injury to the combination disks 7 in the event that an attempt is made to force the locking bolt inward or upward into its unlocked position without operating the combination disks 7, there is provided a detent or dog 46 pivotally supported upon a stud 47 and spring pressed toward the reciprocating bolt 3 whereby it will engage in a notch or recess 48 in said bolt when the bolt is in its operated or locked position. The detent or dog 46 will thereby receive the thrust of any attempted operation of the bolt prior to the operation of the combination disks 7. The extremity of the dog or detent 46 projects into the path of the rock arm 44 whereby the rock arm 44 upon its initial movement will engage said dog or detent and remove it from engagement with the bolt 3. This is best shown by dotted lines in Fig. 2. The notch or recess 45 in the bolt 3 is sufficiently large to permit the rock arm 44 an initial movement by which it disengages the dog or detent 46 before it engages the upper side of

said notch or recess 45 to reciprocate the bolt 3. During the time that the bolt is being shifted the dog or detent rides upon the side of the bolt until the bolt 3 is returned to its operated or locked position whereupon the dog or detent again engages in the notch or recess 48.

In order to prevent the removal of the lid or closure of the housing whereby access may be had to the working parts of the lock by an unauthorized person, locking means are provided for securing the lid or cover in engagement with the housing the unlocking of which is dependent upon the successful operation of the permutation locking mechanism before described. There are provided about the inner periphery of the housing 1 a plurality of spaced lips or ledges 50. Revolvably mounted in a suitable guide upon the inner face of the closure or cover of the housing is a rotatable annular ring 51 having a plurality of lips or extensions 52 registering with the spaces between the lips or ledges 50 of the housing 1. The annular ring 51 is so located upon the closure of the housing that when the closure or lid is in engagement with the housing the annular ring 51 will extend into a plane beyond the plane of the lips or ledges 50 of said housing and by the rotation of the annular ring 51 its lips or extensions 52 may be made to engage beneath the lips or ledges of the housing 1. This locking construction is best shown in Figs. 2, 3 and 4. The guide of the annular ring 51 is apertured as at 53 within which aperture is located a yielding spring detent 54 engaging either one of two notches 55 in the inner periphery of the annular ring 51 thereby retaining the annular ring in its adjusted position. To rotate the annular locking ring from the exterior of the housing there is provided a key 56 adapted to be introduced through a suitable key hole 57 and upon its rotation to engage in a suitable recess 58 in the periphery of the annular locking ring and by its continued rotation to shift the locking ring to move its lips or extensions 52 into and out of registry with the lips or ledges 50 of the housing 1.

To prevent the unauthorized use of the key for attaining access to the permutation lock mechanism there is provided a sliding U shaped member secured to the rear wall of the housing 2, by means of a screw 60 engaging in a slot 61. A spring 62 maintains the U shaped member 59 in its elevated position but said member is depressible as hereinafter mentioned against the tension of said spring 62. The upper arm 63 of the member 59 projects outward into the path of the key 56 as clearly shown in Fig. 2 in which the key and its path of travel are indicated by dot and dash lines. Under normal conditions the key 56 would engage the

arm 63 of the member 59 upon any attempt to rotate the key prior to its engagement with the locking ring 51. The key can only be employed to shift the locking ring 51 by first withdrawing the arm 63 of the member 59 from the path of travel of the key and against the tension of the spring 62. This is accomplished by the means of a lever 64 pivoted upon the rear wall of the housing 2 one extremity of said lever engaging the member 59 and the opposite extremity thereof engaging in a recess 65 in the reciprocating bolt 3. At the initial movement of the reciprocating bolt 3 the lever 64 will be forced from its engagement therewith by the cam like action of the side of the recess 65 thereby oscillating the lever 64 and causing its opposite end to bear down upon the member 59 forcing said member downward against the tension of the spring 62 and withdrawing the arm 63 from the path of the key. It is to be understood of course that the bolt 3 cannot be shifted until the combination disks 7 have been operated as before described. There are preferably provided in the locking bolt 3 two notches or recesses 65 for the engagement of the lever 64, whereby said lever 64 will engage in one of said notches at each limit of the stroke of the bolt 3. Thus the member 59 will only be withdrawn from the path of the key during a brief interval in the operation of the bolt and will be returned to the path of the key by the spring 62 when the bolt 3 has completed its movement in either direction thereby allowing the lever 64 to again enter either one of the recesses 65. Thus the arm 63 is withdrawn from the path of the key permitting the use of the latter only when the bolt is partially operated. Thus in order to remove the cover of the housing it is necessary to first operate the combination disks 7 to release the bolt 3 and then to partially shift said bolt 3 by means of the manually operated handle 43 and while said bolt is substantially at its midstroke to turn the key 56 which will shift the locking ring 51 into unlocked position. It will be obvious that the operator must know the combination of the permutation lock mechanism before he can use the key and that it is impossible to employ the key for the purpose of ascertaining the combination of the permutation mechanism.

Operation: After assembling the several disks upon the main shaft 4 and arranging the other mechanism in proper relation thereto as hereinbefore described the disks are manually adjusted upon the main shaft 4 to bring the several notches or recesses 9 into registry with each other and also into registry with the upper end of the reciprocating locking bolt 3. A pointed instrument is then engaged in the opening 22 in the stop arm 17 of each of the combination disks

7 and the stop arm is drawn outward against the tension of its spring 20 until the lug 18 is disengaged from the notch 8 in the periphery of said disk whereupon the arm 17 is rotated upon the main shaft 4 to a predetermined position indicated by the characters or figures upon the indicator disk 5. In Fig. 2 of the drawing, the several arms have been shown as thus adjusted to positions indicated by 2, 6 and 8 hereby making the combination of the lock mechanism shown in the drawing two hundred and sixty-eight. This implies that one of the disks shall be operated two steps, the second disk operated six steps and the third disk operated eight steps to bring the several notches or recesses 9 into registry with each other and into registry with the locking bolt 3. After setting the combination as before mentioned the knob or handle 38 is rotated thereby rotating the resetting disk 36 and causing its arm 37 to engage the several stop arms 17 of the different disks 7 and rotate said disks 7 to their normal or zero position where their movement is limited by the engagement of stop arms 17 with the stop post 6. The disk 36 and its arm 37 are then rotated in the reversed direction by the handle 38 to carry the arm 37 out of the path of the stop arms 17. The notches 9 of the several combination disks 7 being out of registry with the locking bolt 3 the said bolt will be locked in its operated position. To release the bolt 3 the several operating levers 12 are successively operated by means of their projecting arms 13, the first arm being oscillated twice causing its pawl arm 14 to engage with the ratchet pinion 10 of the first disk 7 and advance said disk one step or the distance of one tooth at each operation. This will bring the notch or recess 9 of the first disk into registry with the locking bolt. The second operating lever 12 is then oscillated through six operations advancing its corresponding disk a distance of six steps or teeth of the ratchet pinion. The last operating lever 12 is then oscillated eight times advancing its corresponding disk eight steps whereupon the several notches 9 will be in registry with each other and with the locking bolt. The knob 43 is then rotated causing the rock arm 44 to first engage the detent or dog 46 and force it out of engagement with the locking bolt 3 and thereafter engage the upper side of the recess 45 to shift the locking bolt upward or inward causing it to enter within the notches or recesses 9 of the several combination disks 7. The upper end of the locking bolt enters within the notches or recesses 9 and engages the inclined cam face 31 of the advance disk 26 and rotates said disk upon the main shaft 4 placing the spring 28 under tension. Upon the rotation of the advanced disk 26 the hook arm 33 en-

gages the notch 32 under the influence of its spring 34 to maintain the advance disk 26 in its operated position. Upon the return movement of the bolt 3 the spring 28 by its expansion advances one of the combination disks 7, with which it is engaged, one step thereby preventing the return movement of the locking bolt 3 and said bolt 3 continuing its movement engages and withdraws the hook arm from its engagement with the advanced disk 26 thereby permitting the several disks to be returned to normal position. In the event that access is desired to the interior of the housing in order to change the combination of permutation mechanism the reciprocating bolt 3 is arrested at its mid-stroke in which position the lever 64 has been disengaged from the notch 65 of the bolt and is riding upon the side face of said bolt as shown by dotted lines in Fig. 2. At this time the lever 64 has depressed the member 59 to withdraw the stop arm 63 from the path of the key. The key may now be rotated, and will in turn rotate the locking ring 51 to move its lips or extensions 52 out of engagement with the corresponding lips or ledges 50 of the housing 1. The cover or closure of the housing is relocked in the same manner.

From the above description it will be apparent that there is thus produced a permutation lock of the character described possessing the particular features of advantage as before mentioned as desirable which is herein illustrated in the preferred form, but which obviously is susceptible of modification within the scope of the appended claims in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

Having thus described my invention I claim:

1. In a permutation lock, a movable bolt, a plurality of independently movable members adapted to normally limit the movement of the bolt but by the predetermined relative movement adapted to release the bolt, adjustable stops carried by each of the members to limit the movement thereof, a stop post adapted to be engaged by said stops, an indicator dial having indicating characters thereon, said indicator dial being fixed in its relation to the stop post, the adjustable stops being capable of adjustment to the different predetermined positions upon the movable members in relation to the stop post such positions being indicated by the characters upon the indicator dial, substantially as specified.

2. In a permutation lock, a movable bolt, a plurality of independently revoluble disks adapted to normally limit the movement of the bolt but adapted upon predetermined relative adjustment to permit the move-

ment of the bolt, a disk adapted to be secured in predetermined position; a stop post carried by said disk, indicating characters carried by said disk, adjustable stop arms carried by the revoluble disks, said stop arms being adapted to be adjusted to different radial positions in relation to the revoluble disks, the indications upon the fixed disk corresponding to the adjusted positions of the stop arms indicating the series of operations necessary to move the disks to position to release the bolt.

3. In a permutation lock, a movable bolt, a plurality of independently revoluble disks adapted to normally limit the movement of the bolt but adapted upon predetermined relative adjustment to permit the movement of the bolt, a stop arm carried by each of the disks, each of said disks having a series of notches therein, a lug carried by any one of the stop arms and adapted to engage one of the notches of the corresponding disk; whereby the arm and disk may be engaged or disengaged by a movement of the arm in a radial direction; the arm being capable of adjustment to different radial positions when disengaged from the disk by a radial movement, and adapted to be engaged therewith in its different relative positions of adjustment by a return radial movement.

4. In a permutation lock, a movable bolt, a plurality of independently revoluble disks adapted to normally limit the movement of the bolt but adapted upon predetermined relative adjustment to permit the movement of the bolt, a stop arm for each of the disks capable of movement in a radial direction and also to different radial positions in relation to the disks, interengaging means between the arm and disk, a spring tending to maintain the arm and disk in engagement, the arm being adapted to be disengaged from the disk by a radial movement thereof against the tension of the spring, and when so disengaged capable of adjustment to different radial positions, and adapted to be reengaged in its adjusted position by the action of the spring.

5. In a permutation lock, a movable bolt, a plurality of independently revoluble disks adapted to normally limit the movement of the bolt but adapted upon predetermined relative adjustment to permit the movement of the bolt, a shaft upon which the disks are mounted, a plurality of stop arms, one for each of the disks also journaled on said shaft but capable of a limited radial movement in relation thereto, a series of notches in the periphery of each of the disks, a lug carried by the stop arm adapted to engage any one of said notches, and a spring tending to move the arm in a radial direction and thereby maintaining the stop arm lug

in engagement within the selected notch, said arm being capable of being disengaged by a radial movement against the tension of the spring and then shifted into engagement with any notch of the series.

6. In a permutation lock, a movable bolt, a plurality of independently movable oscillatory members concentrically pivoted on a common shaft, means whereby the movement of the bolt from locked to unlocked position will advance one of said oscillatory members, and an actuating connection between the advanced member and another member of the series of oscillatory members pivoted on the same shaft whereby such second member will be subsequently oscillated to lock the bolt against movement, substantially as specified.

7. In a permutation lock, a movable bolt, a plurality of independently rotatable stop members adapted to normally limit the movement of the bolt, but adapted by predetermined relative movement to release the bolt, an oscillatory disk pivoted concentrically with one of the said stop members and having therein a cam shaped recess, a spring connecting the oscillatory disk and one of said stop members, the bolt being adapted upon movement to enter the recess of the oscillatory disk and by engagement with the cam side thereof to oscillate said disk to place the spring under tension, said tensioned spring being adapted upon release to move the stop member into locking position, substantially as specified.

8. In a permutation lock, a movable bolt, a plurality of independently movable members adapted to normally limit the movement of the bolt but by predetermined relative movement adapted to release the bolt, an advance member, having a cam face thereon engaged by the bolt upon its movement from locked to unlocked position whereby said advance member will be operated, a spring placed under tension by the movement of the advance member, means for locking the advance member in its adjusted position thereby maintaining the spring tension, said spring being adapted to move one of the movable members to locked position upon the return movement of the bolt, and means for releasing the advance member by a further movement of the bolt.

9. In a permutation lock, a movable bolt, a plurality of independently revoluble disks adapted to normally limit the movement of the bolt but adapted upon predetermined relative adjustment to permit the movement of the bolt, means for manually rotating the disks to release the bolt, an oscillating advance member having a recess therein provided with an inclined wall adapted to be engaged by the bolt in its movement from locked to unlocked position whereby said oscillating advance member will be advanced

a predetermined step, independent of the disks, a spring engaging said oscillating advance member and likewise engaging one of the disks, said spring being placed under tension by the advance movement of the oscillating advance member, a hook arm adapted to engage the oscillating advance member and maintain it in its operated position with said spring under tension, the spring being adapted upon its release by the return movement of the bolt to advance one of the disks to locking position to prevent a reoperation of the bolt, and a projection upon the bolt adapted to engage and withdraw the hook arm to release the oscillating advance member by a further movement of the bolt, substantially as specified.

10. In a permutation lock, a movable bolt, a plurality of independently movable members adapted to normally limit the movement of the bolt but by predetermined relative movement adapted to release the bolt, means for shifting the bolt when the movable members have been adjusted to predetermined positions, a detent adapted to engage the bolt and maintain it in its locked position independent of the said movable members, and means for withdrawing the detent by the initial movement of the bolt shifting means, substantially as specified.

11. In a permutation lock, a movable member to be locked, a plurality of independently movable locking members adapted to normally limit the movement of the movable member but adapted when adjusted to predetermined relative positions to release the movable member, a housing for said parts, a movable closure for said housing, a key operated lock for said closure, adapted to secure the closure in position independent of the locking action of the movable locking members and a stop member normally preventing the operation of said key operated lock, said stop permitting the operation of the key operated lock only when the said movable locking members have been adjusted to predetermined position.

12. In a permutation lock, a movable member to be locked, a plurality of independently movable locking members adapted to normally limit the movement of the movable member but adapted when adjusted to predetermined relative positions to release the movable member, a housing for said parts, a movable closure for said housing, a movable locking member carried by said closure, a key adapted to shift the locking member into and out of engagement with the housing, a stop to prevent the operation of the key to release the closure until the first mentioned movable locking members have been adjusted to predetermined positions, and means for withdrawing the stop to permit the operation of the key when said mov-

able members have been so adjusted, substantially as specified.

13. In a permutation lock, a movable member to be locked, a plurality of independently movable locking members adapted to normally limit the movement of the movable member but adapted when adjusted to predetermined relative positions to release the movable member, a housing for said parts, a movable closure for said housing, an independent locking means for the closure, a stop member normally preventing the operation of said independent locking means, and means to withdraw said stop by the movement of the said movable member to be locked to a predetermined position, substantially as specified.

14. In a permutation lock, a movable member to be locked, a plurality of independently movable locking members adjusted to normally limit the movement of the movable member but adapted when adjusted to predetermined relative positions to release the movable member, a housing for said parts, a closure for said housing, a revoluble locking ring carried by said closure having extensions thereon, extensions within the housing adapted to be engaged by the extensions of the locking ring upon a partial rotation of the latter, a key adapted by its rotation to rotate the locking ring, a stop extending into the path of the key, means for withdrawing the stop from the path of the key by the adjustment of the said movable member to be locked to a predetermined position, and means for manually adjusting the independently movable locking members to positions to release the said movable member to be locked.

15. In a permutation lock, a movable bolt, a plurality of independently movable members adapted to normally limit the movement of the bolt, but by predetermined relative movement adapted to release the bolt, adjustable stops adapted to limit the movement thereof, and means for adjusting the said stops to different positions in relation

to the said movable members without disassembling the structure, whereby said movable members may be allowed a greater or less movement, substantially as specified.

16. In a permutation lock, a movable locking bolt, a plurality of independently movable stop members adapted to limit the movement of the bolt but upon predetermined relative adjustment adapted to release the bolt, an adjustable stop member cooperating with each of the movable members and capable of movement independent thereof, interengaging means between the adjustable stop and movable member adapted to be engaged and disengaged by a reciprocatory movement of the stop in a radial direction, the stop when disengaged being adjustable to various radial positions in relation with the movable member and capable of being reengaged therewith in its new position, whereby varying the extent of the path of travel of the movable member, substantially as specified.

17. In a permutation lock, a movable bolt, a plurality of independently revoluble disks adapted to normally limit the movement of the bolt but adapted upon predetermined relative adjustment to permit the movement of the bolt, a stop arm carried by each of the disks, interengaging means between the disk and stop arm whereby the arm and disk may be engaged or disengaged by a movement of the arm in a radial direction the arm being capable of adjustment to different angular positions upon the disk when disengaged therefrom by a radial movement and adapted to be reengaged therewith in any such position of angular adjustment by a return radial movement, substantially as specified.

In testimony whereof, I have hereunto set my hand this 12th day of October 1911.

BERNARD H. ZIEHLER.

Witnesses:

HARRY F. NOLAN,
EFFIE B. LUTTINGER.