No. 894,520. PATENTED JULY 28, 1908.

M. B. MILLS.

PERMUTATION LOCK.

APPLICATION FILED OCT. 26, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

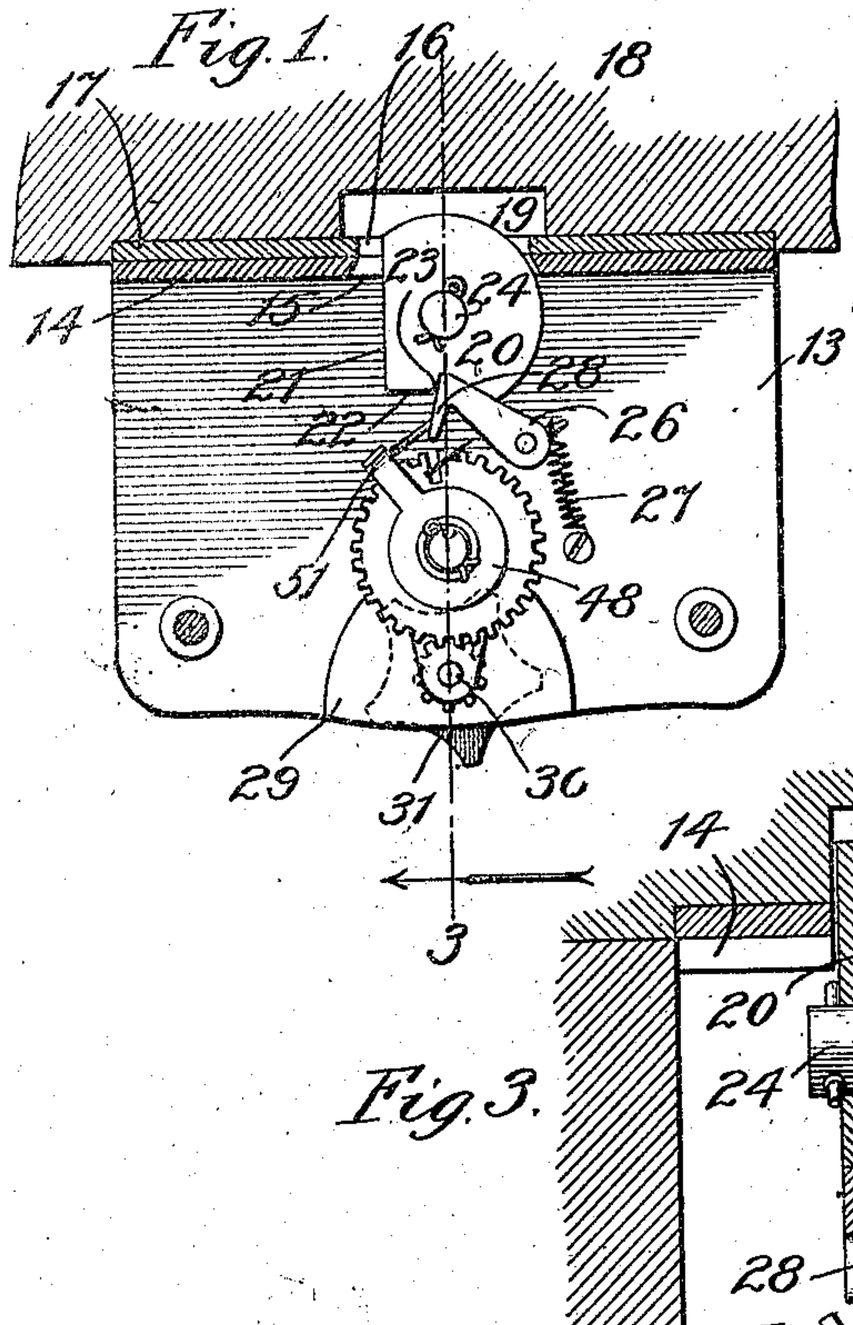


Fig. 2.

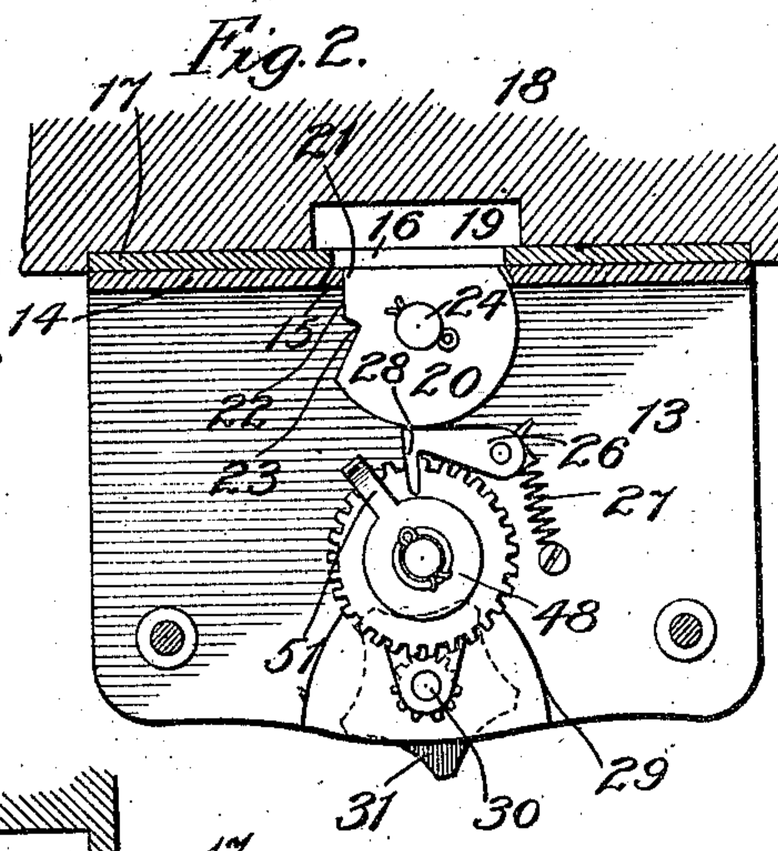


Fig. 3.

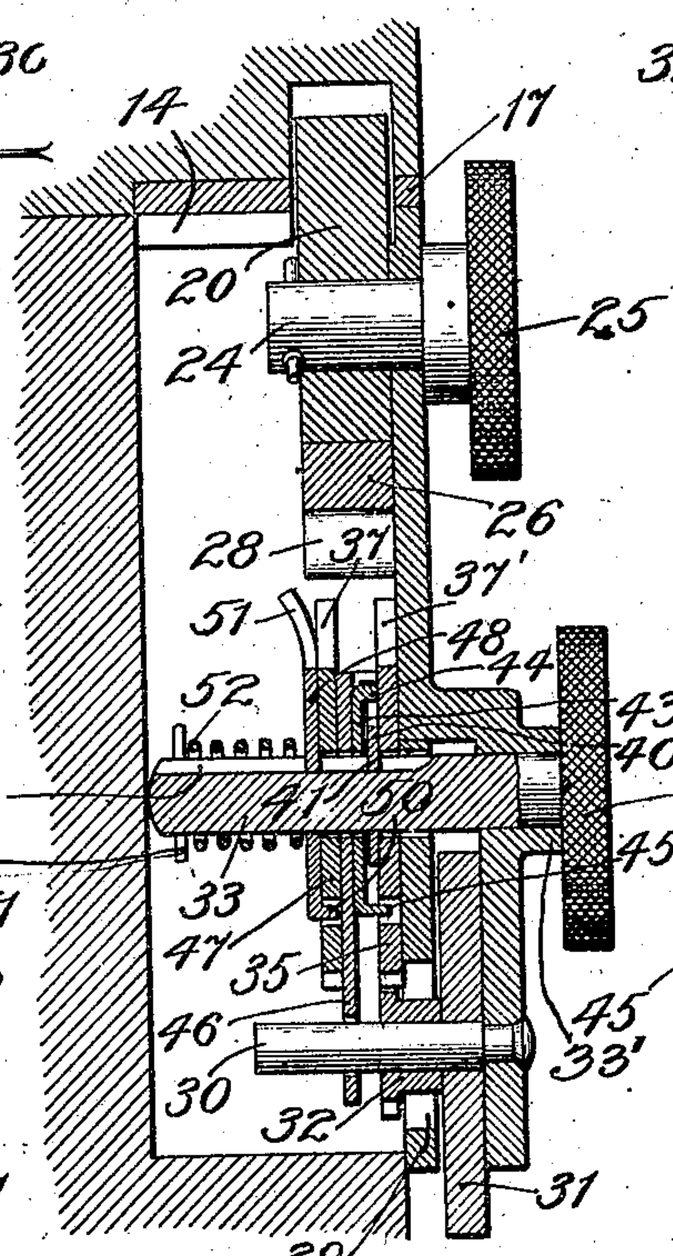


Fig. 5.

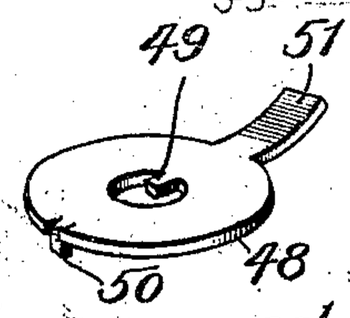


Fig. 8.

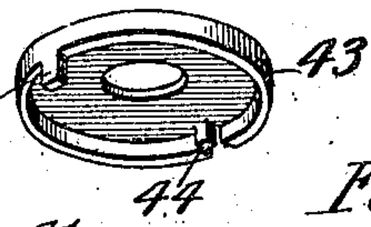


Fig. 7.

Fig. 4.

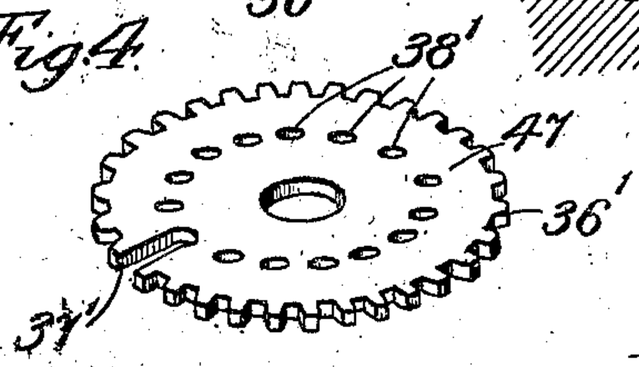
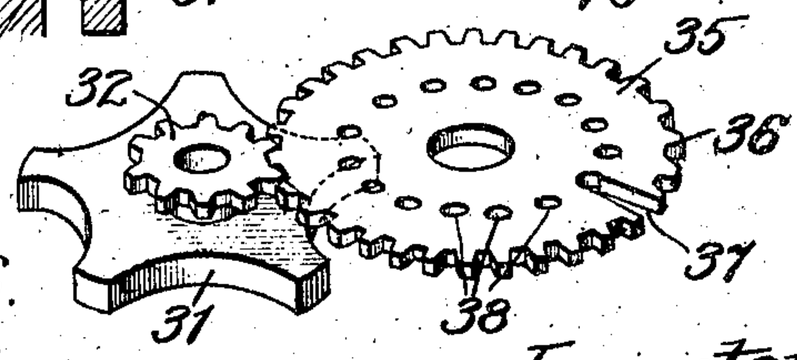


Fig. 6.



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No. 894,520. PATENTED JULY 28, 1908.

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2 SHEETS—SHEET 2.

Fig. 9.

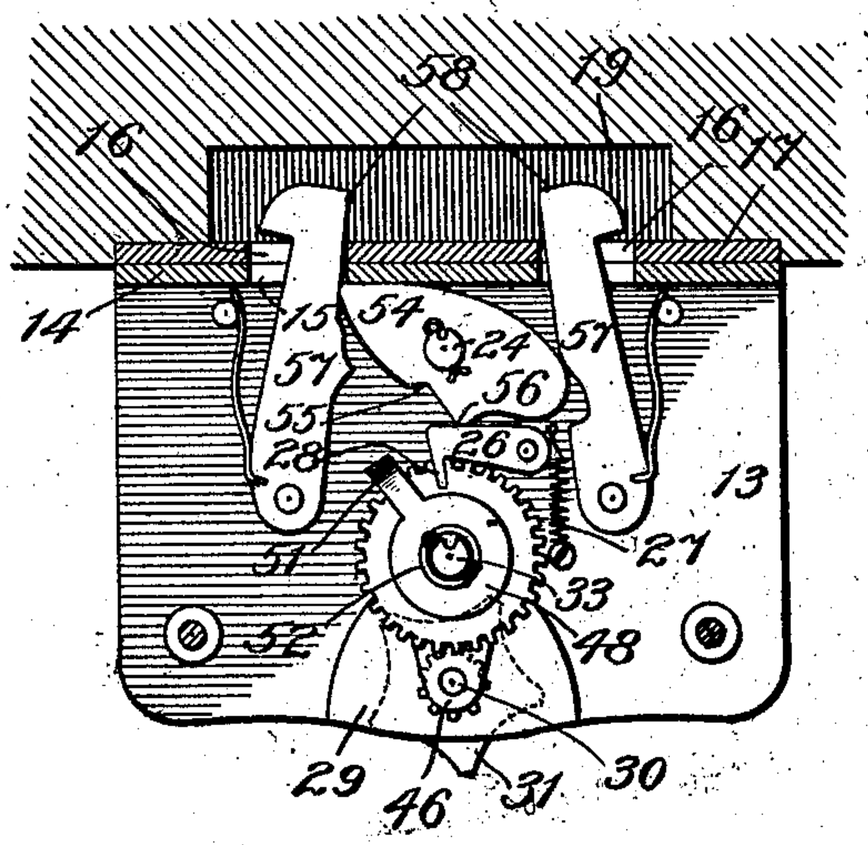


Fig. 11.

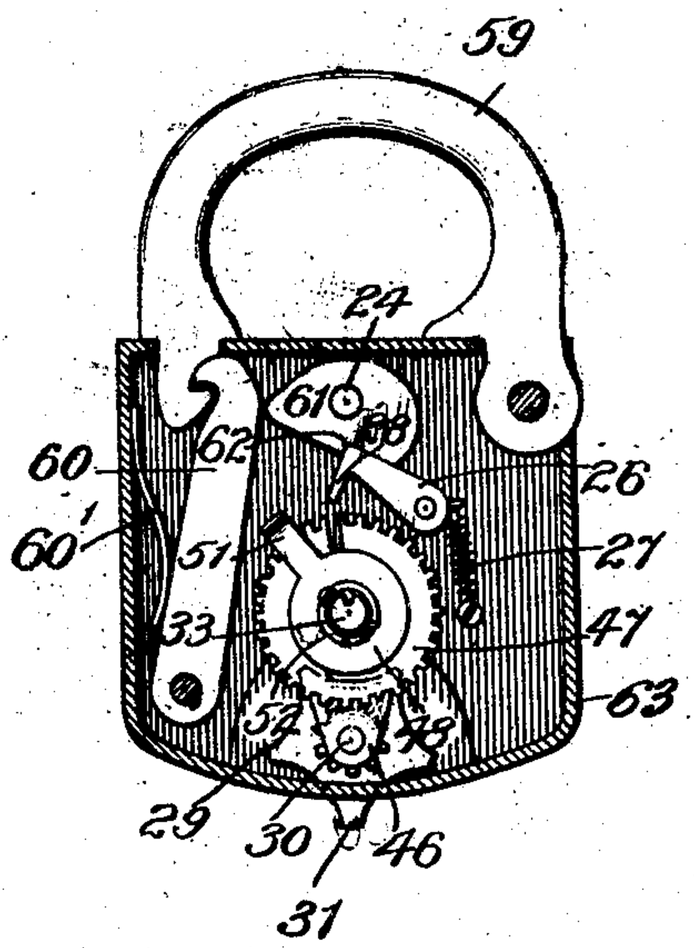


Fig. 10.

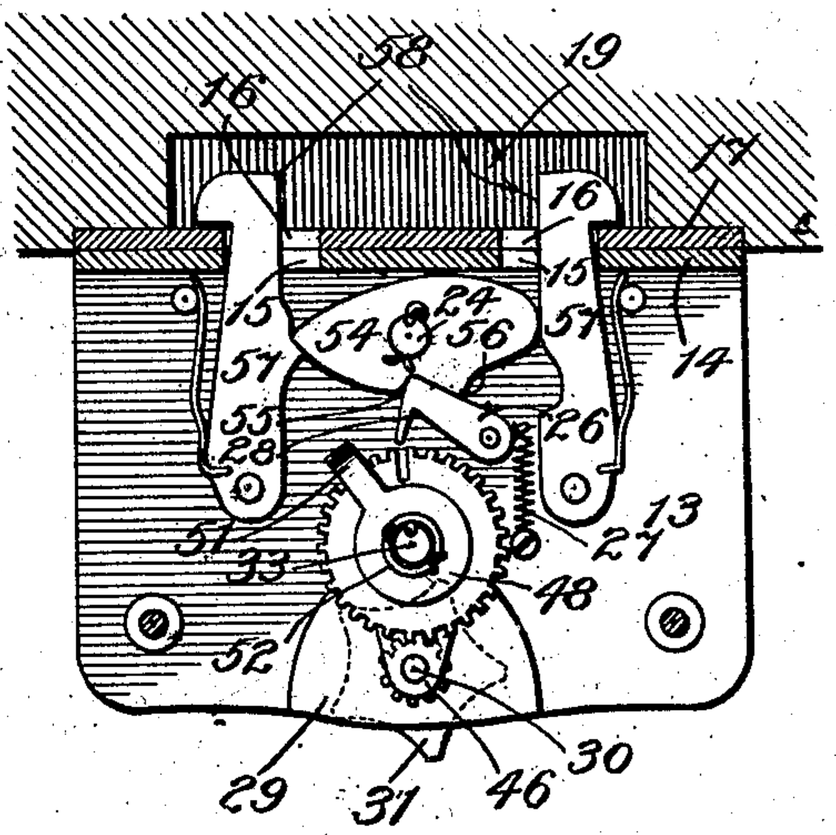
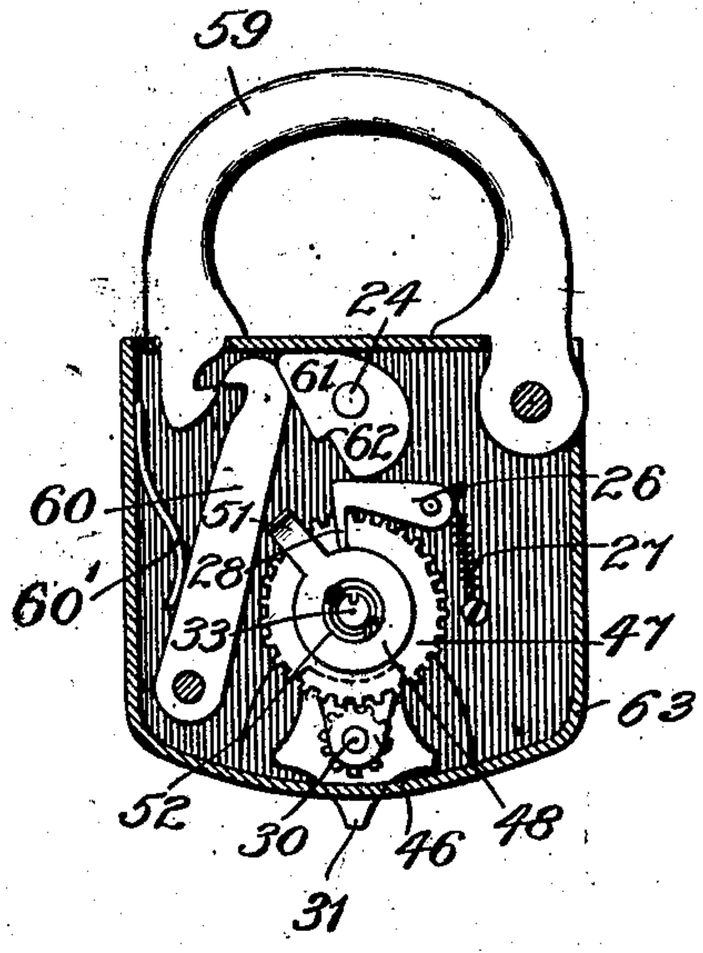


Fig. 12



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UNITED STATES PATENT OFFICE.

MORTIMER B. MILLS, OF CHICAGO, ILLINOIS, ASSIGNOR TO MILLS KEYLESS LOCK & NOVELTY MFG. CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

PERMUTATION-LOCK.

No. 894,520. Specification of Letters Patent. Patented July 28, 1908.

Application filed October 26, 1907. Serial No. 399,269.

To all whom it may concern:

Be it known that I, MORTIMER B. MILLS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Permutation-Locks, of which the following is a specification.

My invention relates to an improvement in permutation-locks; and my object is to provide a novel and simple construction of permutation-lock, to adapt it, more particularly, for desks and drawers, for padlocks, and the like, and which shall enable the parts to be readily assembled by unskilled labor in the manufacture of the lock.

In the accompanying drawings, Figure 1 is a partly sectional inner-face view of my improved lock as adapted to be applied to a drawer, and showing it in locked condition; Fig. 2, a similar view of the same, showing it in unlocked condition, and Fig. 3, an enlarged section taken at the line 3 on Fig. 1 and viewed in the direction of the arrow. Fig. 4 is a perspective view of one of two similar tumblers employed in the construction; Fig. 5, a perspective view of the permuting stop-disk which engages with the tumbler of Fig. 4; Fig. 6, a similar view showing the other of the two tumblers in mesh with a pinion on the lock-operating star-wheel; Fig. 7, a similar view of an annular-disk detail, and Fig. 8, a similar view of a cap detail adapted to coöperate with the tumbler of Fig. 6 for changing the combination and with the disk of Fig. 7. Figs. 9 and 10 are views like those presented, respectively, in Figs. 1 and 2, but showing a modified construction of the lock adapting it for use on a roll-top desk, or the like; and Figs. 11 and 12 are views in vertical sectional elevation of padlocks equipped with my improvement in a form adapted for that species of lock and respectively showing it in locked and unlocked condition.

Referring particularly to Figs. 1 to 8, inclusive, 13 is the supporting-plate for the mechanism, and it is adapted to be fastened against the recessed face of a drawer, or the like (not shown), being provided with a flange 14 which projects at a right-angle from its upper edge to extend over the corresponding edge of the drawer-face, and through which it may, as usual, be screwed down upon such edge. In this flange is provided a slot 15 to register with a similar slot 16 in a bolt-plate 17 fastened in proper position on the frame 18 above the drawer, which frame contains the usual recess 19 registering with the slot 16 to receive the locking-bolt. In the construction illustrated, this bolt, represented at 20, is in the form of a disk having a portion cut away to form the straight edge 21, the disk being also cut away to form an offset 22 extending at a right-angle to the edge 21, and adjacent to which a notch 23 is formed, the disk being centrally secured on a pin 24 journaled in the upper part of the plate and carrying on its outer end a milled head 25 by which to turn it. On the inner face of the plate is pivoted a pawl 26 adapted to engage the notch 23 when in registry with its free end, the tendency to such engagement being produced by a spring 27 connected with the pawl; and from the free end of the pawl there extends a finger 28 for the purpose hereinafter explained.

The particular mechanism thus far described is not, as to its details, essential to my invention, which is embodied in the mechanism described as follows:

In the lower edge of the plate 13 is formed a socket 29, transversely through which extends a stationary pin 30 having journaled upon it the primary finger-operated actuating device of the lock shown in the preferred form of a star-wheel 31 provided centrally on its inner face with a pinion 32. The star-wheel shown is provided with five points at equal intervals apart with the periphery concaved between them, and it is so positioned in the recess as to cause the points to protrude beyond its lower edge, when they successively register therewith, to render them conveniently accessible for manipulating the lock, as and for the purpose hereinafter described.

The wheel 31 with its projecting points and the pinion 32 form essential elements of my improved lock, and it is important that the number of teeth on the pinion shall either correspond with the number of points on the wheel or be a multiple thereof. A shaft 33, carrying on its outer end a milled head 34, is journaled in a bearing 33^1 extending from the face of the plate in vertical alinement with the pin 24 and carries loosely upon it a tumbler 35 in the form of a disk having peripheral teeth 36, shown to be thirty in number and thus a multiple of the teeth on the pinion 32, which meshes with the tum-

bler, though the number of the teeth 36 is immaterial. A radial slot 37 is provided in this tumbler, and it also has formed in it about its center a desired number of holes 38 for setting the combination as hereinafter described. The shaft 33 contains a longitudinal groove 39 and is surrounded adjacent to the tumbler 35 by an annular disk 40 having an inwardly-projecting tongue or key 41 to enter said groove for rotating the disk with the shaft, and a tongue 42 projecting from its periphery. An annular cap 43 loosely surrounds the shaft 33 to cover the disk 40 and has a lug 44 extending from it into the path of the tongue 42 and a stud 45 adapted to register with the circular series of holes 38 in the tumbler 35. A washer 46 extends from the pin 30 and loosely surrounds the shaft 33 to cover the inner face of the cap 44. Another tumbler 47 loosely surrounds the shaft adjacent to the washer and is shown to be of precisely the same construction as the tumbler 35, being provided with teeth 36^1, a radial slot 37^1 and a circular series of holes 38^1. It is not necessary, however, that the tumbler 47 be toothed. An annular stop-disk 48 fits about the shaft 33 adjacent to the tumbler 47, with which it is caused to rotate through the medium of a tongue or key 49 projecting into the groove 39; and this disk is provided on one edge with a stud 50 to register with the circular series of holes 38^1, and with a radially-extending stop-finger 51, shown to be slightly curved, diametrically opposite the stud 50. The elements supported on the shaft 33 are resiliently confined one against the other by a coiled-spring 52 about the inner end of the shaft and confined against the face of the stop-disk 48, as by a cotter-pin 53.

To enable the lock to be opened from the condition represented in Fig. 1 to that represented in Fig. 2, the slots 37 and 37^1 in the two tumblers must register with the finger 28 on the pawl 26, in order that said finger may enter them and thus withdraw the pawl from engagement with the notch 23 in the bolt 20 to enable the pin 24 to be rotated for turning the bolt out of the slot 16 and recess 19. To thus register the tumbler-slots, the star-wheel 31 is manipulated in a manner depending upon the particular combination for which the lock is set. The operation of unlocking is started with the stop-finger 51 abutting against one side or the other of the pin 30, which may be considered the zero position. The star-wheel is turned by applying a finger, as the forefinger, to the projecting point of the wheel and wiping the finger down along the adjacent edge of the plate until another point protrudes beyond the latter for another similar manipulation by the finger, these manipulations being repeated the number of times required for the predetermined combination known to the operator. Thus turning the star-wheel in one direction rotates in that direction both tumblers, since the tumbler 35 is rotated by the pinion 32 and rotates with it the cap 43 by engagement with a hole 38 of the stud 45, and in the rotation of the cap the lug 44 thereon abutting against the tongue 42 on the disk 40 turns the latter and causes the tongue 41, which is in the shaft-groove 39, to turn the shaft, and also turn the tumbler 47 by reason of the engagement with a hole 38^1 therein of the stud 50 on the stop-disk 48, the tongue 49 on which is in the shaft-recess 39. When the star-wheel has been turned in the one direction the predetermined number of times to bring the slot 37^1 in the tumbler 47 into registration with the pawl-finger 28, to then bring the slot 37 in the tumbler 35 into the same registration the star-wheel is turned the predetermined number of times in the other direction by successively manipulating the projecting points. In turning the star-wheel, as last described, the tumbler 47 remains stationary, since in the rotation of the tumbler 35 in that direction the lug 44 on the cap turns away from the tongue 42 on the disk 40, thus without causing the latter to rotate the shaft and consequently without causing it to rotate the tumbler 47. With the slots of both tumblers thus brought into registration with each other and with the pawl-finger 28, the pin 24 may be turned to withdraw the bolt 20 in the manner described.

To change the combination it is but necessary to separate the stop-disk 48 from the tumbler 47, or the cap 43 from the tumbler 35, or both, in the one instance withdrawing the stud 50 from one hole 38^1 and introducing it into another by slightly turning the stop-disk, and in the other instance withdrawing the stud 45 from a hole 38 and introducing it into another hole in the tumbler 35 by slightly turning the cap. Such separation may easily be effected by introducing a suitable sharp instrument, such as a blade of a pen-knife, underneath either the stop-disk 48 or the cap 43, or under both in succession to prize them against the resistance of the spring 52.

The construction of the star-wheel, pinion and parts on the shaft 33, and also of the pawl 26 as shown in Figs. 9 to 12, inclusive, and their operation, are the same as described with reference to Figs. 1 to 8, inclusive. In Figs. 9 and 10, the rotary pin 24 carries on its inner end a cam 54 containing a notch 55 to receive the pawl 26 in the position of the cam represented in Fig. 10, and provided with a projection 56 to engage the pawl in the position of the cam represented in Fig. 9. This cam extends between two similar spring-pressed latch-bolts 57, 57, the tendency of their spring-pressure being to force them toward each other at their free

ends carrying lateral tongues 58, 58, to enter a recess 19 through slots 15, 16, and disengage them from the plate 17 as represented in Fig. 9, as for unlocking the roll-top of a desk. When the tumbler-slots and pawl-finger are brought into registration, the pin 24 may be rotated to turn the cam 54 to the position represented in Fig. 10, wherein it receives the pawl into the notch 55 and spreads the latch bolts 57 apart against the resistance of their spring-pressure to engage the tongues 58 on their free ends with the plate 17 and thus lock the desk.

For the padlock, the free end of the shackle 59 is adapted to be engaged, for locking it, by a catch 60, against which is confined a spring 60^1 tending to disengage it when released from the locking action of a cam 61 on the rotatable pin 24, containing a notch 62 to receive the spring-controlled pawl 26, the finger 28 of which, when it registers with the tumbler-slots, will be introduced into them by turning the pin 24 to rotate the cam to the position represented in Fig. 12, wherein it turns the pawl to enter its finger into said slots and free the catch 60 under the action of its spring to unlock the shackle. In the padlock the case 63 is substituted for the plate of the preceding figures to afford a support for the lock-mechanism.

Obviously, the number of the tumblers employed, with the coöperating means for changing the combination of each, may exceed two, and it is within my invention to employ only the tumbler 35, though with consequent reduction to the minimum of the possible number of changes of combinations.

As will be observed, with the five-pointed star-wheel and pinion provided with twice the number of teeth, which is the construction shown, a complete turning out of the way of a point, by wiping it with the finger in the manner described to bring the next succeeding point to project centrally of the socket 29 causes the pinion to turn to the extent of two teeth. However, the star-wheel may be so operated as always to cause two adjacent points upon it to protrude equally beyond the edge of the socket 29 at opposite sides of the perpendicular center thereof, thereby enabling the operating-finger to manipulate each point in succession and thus double the number of manipulations in turning the star-wheel in each direction.

What I claim as new and desire to secure by Letters Patent is—

1. In a permutation-lock, the combination with a support for the mechanism, of a bolt, a star-wheel having a predetermined number of points, journaled on the support to protrude, by its rotation, said points in succession beyond an edge of the support, a pinion connected with the star-wheel, the number of teeth on which bears a predetermined relation to the number of said points, a pair of tumblers with interengaging means for turning one by the other, each tumbler consisting of a toothed wheel containing a slot and journaled on the support to mesh one of said tumblers with the pinion, and releasable locking-means for said bolt coöperating with said slotted tumblers, for the purpose set forth.

2. In a permutation-lock, the combination with a support for the mechanism, of a bolt, a star-wheel having a predetermined number of points, journaled on the support to protrude, by its rotation, said points in succession beyond an edge of the support, a pinion connected with the star-wheel, the number of teeth on which bears a predetermined relation to the number of said points, a pair of tumblers with interengaging means for turning one by the other, each tumbler consisting of a toothed wheel containing a slot and journaled on the support to mesh one of said tumblers with the pinion, permuting mechanism on said tumblers and releasable locking-means on said bolt coöperating with said slotted tumblers, for the purpose set forth.

3. In a permutation-lock, the combination with a support for the mechanism, of a bolt, a star-wheel journaled on the support to protrude, by its rotation, the points thereon in succession beyond an edge of the support, a pinion connected with the star-wheel, a shaft journaled on the support, a tumbler consisting of a toothed wheel on the shaft meshing with the pinion and containing a slot and provided with holes, an annular disk keyed to the shaft and provided with a tongue, a cap surrounding the shaft to cover said disk and provided with a stud to engage one of said holes and with a lug to engage with said tongue, and releasable locking-means for said bolt coöperating with said slotted tumbler, for the purpose set forth.

4. In a permutation-lock, the combination with a support for the mechanism, of a bolt, a star-wheel having a predetermined number of points, journaled on the support to protrude, by its rotation, said points in succession beyond an edge of the support, a pinion connected with the star-wheel, with its teeth forming a multiple of the number of star-wheel points, a pair of tumblers with interengaging means for turning one by the other, each tumbler consisting of a toothed wheel containing a slot and journaled on the support to mesh one of said tumblers with the pinion, and a spring-pawl coöperating with said slotted tumblers and bolt, for the purpose set forth.

5. In a permutation-lock, the combination with a support for the mechanism, of a bolt, a star-wheel journaled on the support to protrude, by its rotation, the points thereon in succession beyond an edge of the support, a

pinion on the star-wheel, a shaft journaled on the support, a tumbler consisting of a toothed wheel on the shaft meshing with the pinion and containing a slot and provided with holes, an annular disk keyed to the shaft and provided with a tongue, a cap surrounding the shaft to cover said disk and provided with a stud to engage one of said holes and with a lug to engage said tongue, a second tumbler consisting of a slotted wheel on said shaft, provided with holes, a stop-disk keyed to the shaft and provided with a stud to engage a hole in said second tumbler and with a stop-finger, and a spring-pawl coöperating with said slotted tumblers and bolt, for the purpose set forth.

6. In a permutation-lock, the combination with a support for the mechanism, of a star-wheel journaled on the support to protrude, by its rotation, the points thereon in succession beyond an edge of the support, a pinion on the star-wheel, a shaft journaled on the support, a tumbler consisting of a toothed wheel on the shaft meshing with the pinion and containing a slot and provided with holes, an annular disk keyed to the shaft and provided with a tongue, a cap surrounding the shaft and provided with a stud to engage one of said holes and with a lug to engage said tongue, a second tumbler consisting of a slotted wheel on said shaft, provided with holes, a stop-disk keyed to the shaft and provided with a stud to engage a hole in said second tumbler and with a stop-finger, a spring-pawl terminating in a finger to enter the tumbler-slots, a cam journaled on the support to engage said pawl, and a spring-pressed bolt with which said cam engages, for the purpose set forth.

MORTIMER B. MILLS.

In presence of—
RALPH SCHAEFER,
W. T. JONES.