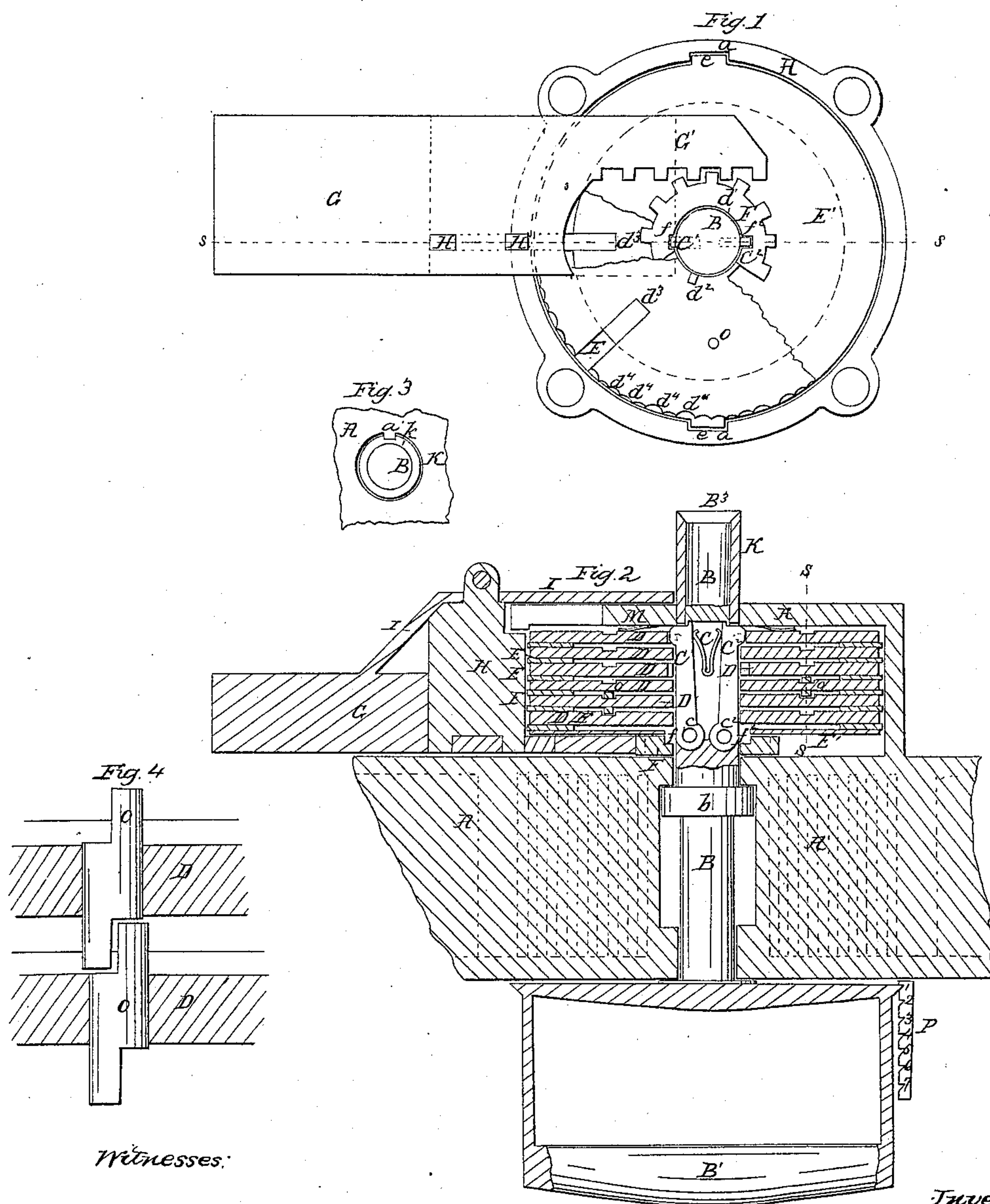


G. Hopson,
Permutation Lock.

N^o 43,501.

Patented July 12, 1864.



Witnesses:

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IMPROVEMENT IN LOCKS.

Specification forming part of Letters Patent No. 43,501, dated July 12, 1861.

To all whom it may concern:

Be it known that I, GEORGE HOPSON, of Bridgeport, in the county of Fairfield and State of Connecticut, have invented a certain new and useful Improvement in Locks, intended more particularly for use on the doors of safes, banks, and the like important structures; and I do hereby declare that the following is a full and exact description of the construction and operation of the same.

The accompanying drawings form a portion of this specification.

Figure 1 is a front view, with portions removed to show the interior organization. Fig. 2 is a horizontal section on the line S S in Fig. 1. Fig. 3 is a cross section of the shaft near its rear end. Fig. 4 is a magnified section of a portion of two of the guard wheels D on the line S S in Fig. 2.

Similar letters of reference indicate like parts in all the drawings.

Tints are employed to aid in distinguishing parts, and do not indicate the materials employed, which may be of any ordinary character.

My lock is of the class known as "dial-locks," which locks are operated without the aid of a key. I provide a strong and convenient handle, by which the shaft may be grasped and made to perform all the functions, both of rightly adjusting the guard-plates or tumblers in the lock, and also of communicating the proper force to the bolt to move it. The bolt has attached to it a guard-bar which traverses across the back of the lock. It carries also the tongue or fence, which abuts against and enters the guard-wheels or tumblers, and a rack by which it receives motion. A pinion gears with this rack, and when acted upon by certain spurs on the shaft runs the bolt. The shaft is made to revolve and slide in and out. When in, it forms an abutment or stop for the guard bar. It carries the spurs, an anti-friction tube, an index-plate, and a handle. The guard-wheels and the pinion turn upon it as their axis. It has a collar to limit its motion endwise. The spurs are made to slide in the shaft if violently pulled or pushed, and are forced out with a spring. They take hold of but one wheel or pinion at one time and turn it. The anti-friction tube is held from revolving by a pin or nipple in the casing of the lock, which fits in a groove in the tube.

Its object is to protect the wheels after they are set from being influenced by the motion of the shaft. The guard-bar on the bolt prevents the tongue or fence from being pressed against any of the guard-wheels until the spurs which move them are withdrawn from the entire series. It is strongly attached to the bolt and abuts against the shaft, or, rather, against the tube thereon, until the spurs enter the pinion, when it is at liberty to pass across the end of the shaft. Each guard-wheel is made with false notches around its outer edge of irregular depths. Each has one true or deep notch to receive the tongue of the bolt. Each has also one pin running through it, and one or more notches on its inner edge, or around the hole in its center adapted to receive the spurs. These guard-wheels are free to turn, and are placed in the casing alternately with certain fixed disks, and all are pressed gently together by a spring and prevented from revolving by friction. These disks, which I have termed "fixed," are allowed to move slightly, but not to revolve. They have each one or more ears fitting into corresponding recesses in the case, by which they are held from revolving. Their use is to keep the guard-wheels properly apart and to hold them in the positions in which they are left by the spurs. The pins in each wheel project through so as to interlock with each other, and are so made and set that the surfaces which come in contact shall all be in line. The wheels can be transposed and the combination varied.

In the drawings, A represents the fixed casing of the lock.

B represents the shaft, which is free to turn therein, and also to move endwise to a limited extent.

A collar, b, serves, by the aid of the adjacent parts, arranged as represented, to limit the endwise movements of the shaft.

B' is a stout handle, by which the shaft is operated. The latter stands on the exterior face of the door. The lock itself is on the interior face, or near the interior face of the door, and is well guarded from violence and from access by drilling. A head, B³, is on the extreme rear end of B. It serves to retain the tube K, which envelops that portion of B which is beyond the spurs C' C². This tube travels endwise with every endwise movement of B, but does not rotate therewith, being pre-

vented from doing so by the presence of a projection, a' , from the casing A, which stands in a groove, k , as shown in Fig. 3.

$C' C^2$ are spurs carried in the shaft B and projecting therefrom on opposite sides. They are hinged or mounted on pivots $c' c^2$, and are urged outward by a spring, C.

D D, &c., are guard-wheels or rotating disks, which serve the function of such disks as usually are employed in this class of locks, which is to prevent the withdrawal of the bolt except when all are rightly arranged. Each has a deep notch, d^3 , and a number of false notches, d^4 , on its exterior edge, and each has two notches, $d' d^2$, on its interior edge corresponding with the spurs $C' C^2$. These two spurs $C' C^2$ are not alike in form. I make one broad and projecting but a little way; the other narrow and projecting to a greater distance, as indicated in Fig. 1. The notches $d' d^2$, on the interior edge of each guard-wheel D, correspond in form to these spurs, so that there is but one position of the wheel D which can correspond with any given position of the shaft B.

E E, &c., are friction-rings standing between each of the guard-wheels D, as represented, and prevented from turning by their projections $e e$, which extend into corresponding recesses $a a$ in the interior of the casing A. These recesses allow the rings E to move so as to adjust themselves to any wear of the guard-wheels D, but do not allow them to turn with those wheels. They remain and create a constant friction, which tends to hold the guard-wheels D in any position in which they may be left by the other parts.

M is a spring which exerts a constant pressure on the rear face of the back plate. This pressure holds all the guard-wheels D and friction-rings E intimately together, but not so tightly as to prevent the guard-wheels D from being turned by a force directly applied for the purpose. The front face of the front friction-ring, E, rests against an annular plate E' , which is prevented from turning by projections entering the recesses a in the same manner as the friction-rings E. The front face of this plate E' rests against a stout gear-wheel or pinion, F, and thus tends to prevent its motion also, except when a force is directly applied to turn it.

G is the bolt, and G' a rack, which is a prolongation of the same. The teeth of this rack G' mesh into the teeth of the pinion F, so that on drawing out the handle B' so that the spurs $C' C^2$ shall enter the recesses $f' f^2$ on the interior of the pinion F, the turning of the shaft B will turn or tend to turn the pinion F, and by the aid of the rack G' withdraw or tend to withdraw the bolt G.

H is a fence, knife-edge, or tongue fixed firmly to the bolt G in the position represented. It stands in such a position as to present its edge simultaneously across the peripheries of all the guard-wheels D whenever the bolt G is withdrawn. If the guard-wheels D have

been previously so arranged that the deep notch d^3 on each coincides exactly with the position of the fence or tongue H, the latter will be received into these notches and allow the bolt to be withdrawn to its full extent; but if one or more of the guard-wheels D is in a wrong position, the tongue H will meet the edge of that guard-wheel and may enter one of the false notches d^4 , but will not allow the bolt to be withdrawn to a sufficient extent to unlock the door.

I is a stout arm, fixed on the bolt G and on the fence or tongue H, and extending along the rear face of the lock in the position represented. It serves to brace the fence H very securely, and by striking against the tube K prevents the throwing back of the bolt G by any violence or by any ingenuity until the shaft B and its attachments are drawn out to their proper extent.

O O are pins soldered or otherwise firmly fixed in each guard-wheel D, so as to project from each face thereof. Half of each pin is filed away, as represented, so that the acting surface on that part of the pin which projects on the front side of each guard-wheel is exactly in line or in the same plane as the acting surface of that part which projects on the rear side of the same guard-wheel. This condition is shown very plainly in the magnified view, Fig. 4. A circular recess is produced in each of the guard-wheels in the path of these pins O. This allows the pins to be somewhat longer than would be otherwise practicable without increasing the thickness of the lock, and allows the maintenance of a proper thickness, and, consequently, a proper strength in the other portions of each of the guard-wheels.

P is a slight arm, notched as represented, and serving as a guide to indicate the proper position of the shaft B in its endwise movements. The arm P is hung on a lever and pressed by a slight spring against the circular base of the handle B.

Operation: The bolt being thrust out by turning the handle B' properly while it is drawn out to its full extent, the door is locked, but the tumblers are as yet in the position which allows the bolt to be readily withdrawn by a reversed turn of the handle, and before leaving the door it is well to throw the tumblers into some different positions. I do this by pushing the handle inward, so as to press the rear face of spurs $C' C^2$ against the front of the forward guard-wheel, D. This takes it out of contact with the pinion F, and allows it to rotate without producing any effect until it arrives to that position in which the spurs $C' C^2$ coincide exactly with the corresponding notches on the interior of the forward guard-wheel. When this point is reached, it immediately enters and engages therewith. I now turn it continuously around from right to left, making several complete revolutions. The effect is to cause the front guard-wheel to revolve alone until its pin O strikes the pin of

the next, then to cause both of these to revolve until the pin on the second strikes the pin on the third, and then to revolve all three until the pin on the third strikes the pin on the fourth, and so on until all are moved simultaneously. In this condition the notches d' d^2 are all in line, and I now stop the rotating movement and thrust the handle B' bodily inward. This moves the shaft B and its attachments freely inward to its full extent. I then turn in the same direction a little farther, which has the effect to turn the rear guard-wheel, D , directly and the others indirectly by the aid of the pins O , and to leave them in uncertain positions. The parts are now in the position represented and the door is effectually locked. The owner and his proper confidential clerks are previously instructed how to open it. My arrangement is intended to prevent all others from opening it, either by violence or skill.

The process of unlocking is as follows: I seize the handle B' and give it several turns from left to right. This brings all the wheels into the position described—that is, so that the pin on each is fairly in contact with the pin on the next, and that all turn together. If I am certain that the guard wheels D have been left exactly in that position, this preliminary operation of turning before commencing to unlock may be dispensed with. I now commence to turn farther in the same direction, and when at the right point to leave the rearmost guard-wheel, D , which is determined by observing the numbers on the dial outside, which numbers must be previously known to the owner of the lock, but must not be accessible to the public generally. I suspend the operation of turning for a moment and draw out the shaft B and its connections to the extent indicated by the space between the notch 1 and the notch 2 on the arm P . This operation takes the spurs C' C^2 out of contact with the rearmost guard-wheel, D , and a further turning of the handle B' causes these spurs to act directly on the second guard-wheel, turning it and those in front of it as before, but leaving the rearmost quiet. In this condition I turn until the proper point is reached in which to leave the second guard-wheel D , and then suspend the turning and draw the shaft one notch farther out. I repeat this operation until I have left the sixth notch, and consequently have adjusted all the tumblers. I now very readily draw out the handle farther and turn it so as to enter and take a secure hold of the pinion F , when a little farther turn, made with proper force, withdraws the bolt by the action of the rack G' . It will, of course, be understood that the handle B' is, in part at least, a cylinder, and is graduated and numbered or lettered, so as to conveniently indicate the positions desired, and the several points at which it should stand to allow all the several guard-wheels D to be left in their proper positions must be carefully observed when the lock is adjusted

and be communicated to the owner of the lock in writing or otherwise, so that he shall be able to adjust his handle in the proper position at each stage of the operation.

By opening my lock, which can be readily done from the rear side of the door when the door is swung open, I am able to change the positions of my guard-wheels D at pleasure, and every such change involves a new series of numbers or letters, by a knowledge of which the lock can be opened. If at any time the owner has reason to suspect any improper party has gained a knowledge of the means of opening his lock, he has simply to make this change and familiarize himself and clerks with the new numbers or letters.

It will be observed that the friction rings E are necessarily open at the point where the fence H enters them. This condition is plainly indicated in Fig. 1.

Some of the advantages due to certain features of my invention may be separately enumerated as follows:

First. By reason of the shaft B and handle B' , being adapted to both adjust the parts and apply the force for moving the bolt, my lock is made very efficient and simple.

Second. By reason of the spurs C' C^2 , mounted and operated as described, I insure their proper introduction into the corresponding notches or recesses in the guard-wheels D and pinion F , and at the same time provide for their becoming inefficient by their sinking into the shaft B whenever they are subjected to any violent thrusting or pulling force. The spurs are sufficiently beveled or rounded, so that on violence being applied to the handle B' , either to thrust it in or pull it out improperly, the inclined faces of the spurs acting against the inner edges of the guard-wheels will deflect the entire spurs inward by the compression of the spring C , and thus save the works of the lock from any serious injury.

Third. By reason of my tube K , arranged as specified, I insure the protection of the inner surfaces of the guard-wheels D from being influenced by the rotation of the shaft B after they have been set in place.

Fourth. By reason of my guard-wheels D , with their interior notches, d' d^2 , and pins o , arranged as represented relatively to each other, and to the several connections, I am able to adjust the whole with certainty and with delicacy by alternately turning and drawing out without necessitating more than one or two complete revolutions to properly set a large number of wheels, and am certain that the shaft or operating part matches but in one position, while it distributes the turning-strain equably on opposite sides of the center.

Fifth. By reason of my pins O having one-half of their projecting ends removed, leaving the part one side of the plane on the axis at one end, and the other side of the same plane at the other end, so as to be adapted to apply each to its neighbor, in the manner represented in Fig. 4, I am able to transpose the guard-

wheels D, and thus to very readily change the combination of my lock, and yet preserve such a relation of the parts that the proper position in which to leave each shall coincide exactly with some one of the number or marks on the graduated index.

Sixth. By reason of the guard-bar I, arranged as represented, I insure that the fence or guard-plate H cannot be forced against the edges of the guard-wheels D while the operating-shaft B is in the position for moving or feeling them.

Seventh. By reason of the semicircular or curved form of the false notches d^1 , and the corresponding form of the edge of the guard H, I am able to introduce a greater number of false notches in the periphery of each of my wheels D than would be possible were the ordinary rectangular form adopted.

Having now fully described my invention, what I claim as new therein, and desire to secure by these Letters Patent, is as follows:

1. In combination with the shaft B and guard-wheels D of a dial lock, the spurs c^1 and c^2 , or either of them, so arranged as to rotate the tumblers thereby, and to retreat or sink

into the shaft, substantially in the manner and for the purpose above specified.

2. The arrangement of the tube K relatively to the shaft B, head B^3 , and guard-wheels D, or their respective equivalents, as herein specified.

3. The series of guard-wheels D, with the differing notches d^1 d^2 and the pins O, arranged relatively to the shaft B and spurs C^1 C^2 , so as to operate in the manner substantially as herein specified.

4. In a dial-lock, the within-described arrangement and form of the pins O, whereby their working-faces on opposite sides of a guard-wheel, D, lie in one and the same plane, for the purpose herein specified.

5. In combination with the bolt G and shaft B of a dial lock, the guard-bar I, arranged to strike against the tube K, or an equivalent moving stop, arranged and operated substantially in the manner and for the purpose herein set forth.

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Witnesses:

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