(No Model.) 2 Sheets—Sheet 1.

W. A. JOHNSTON.

LOCK.

No. 558,649. Patented Apr. 21, 1896.

Fig. 1.

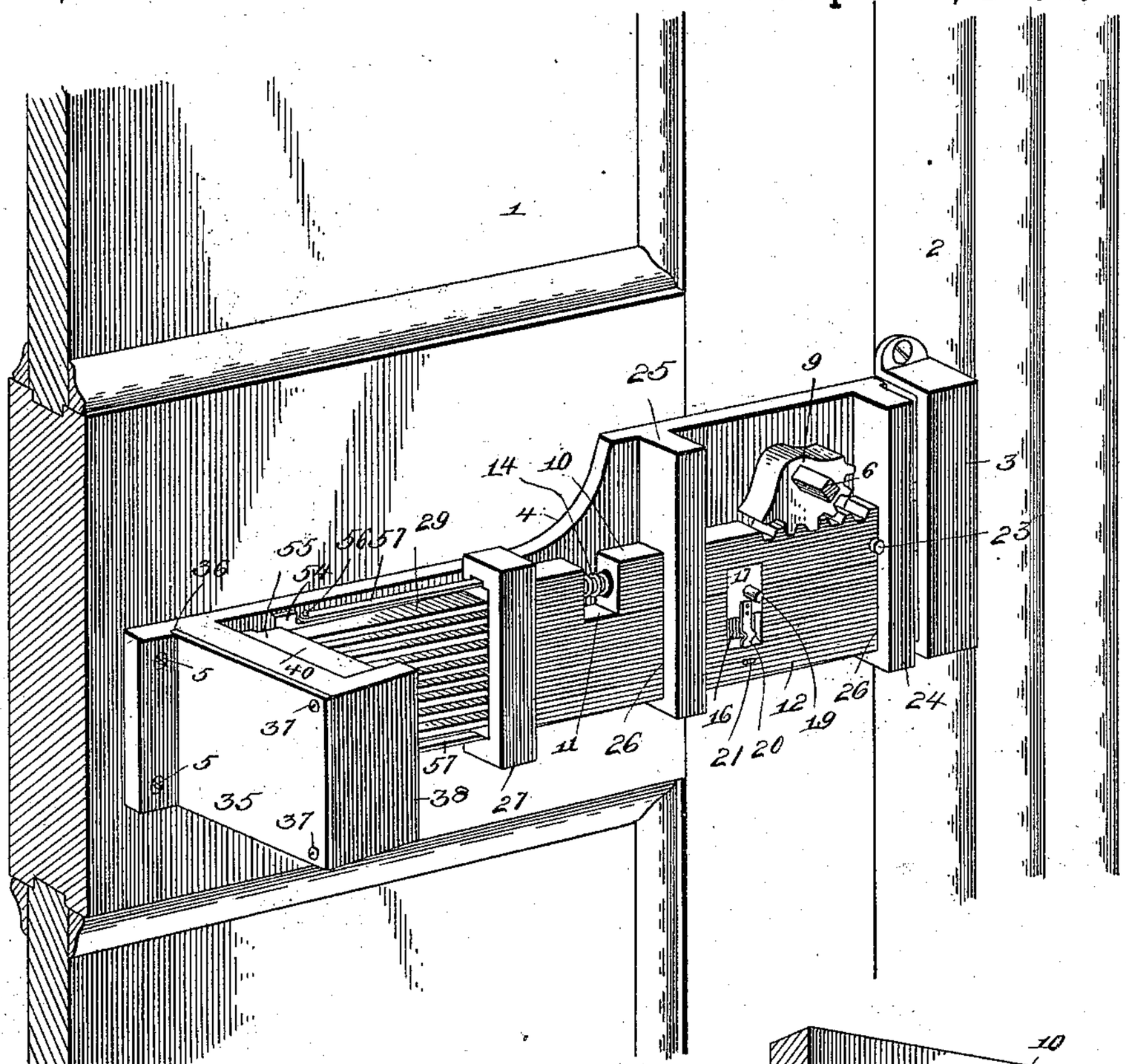


Fig. 5.

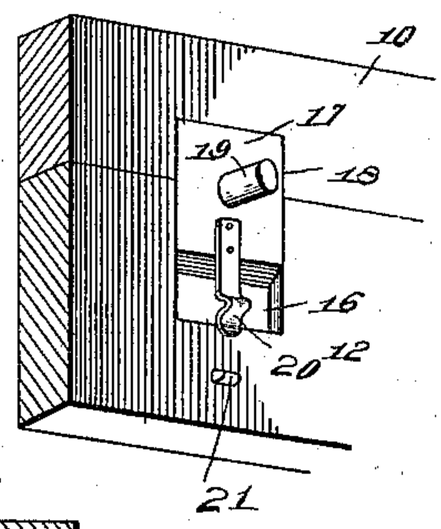


Fig. 3.

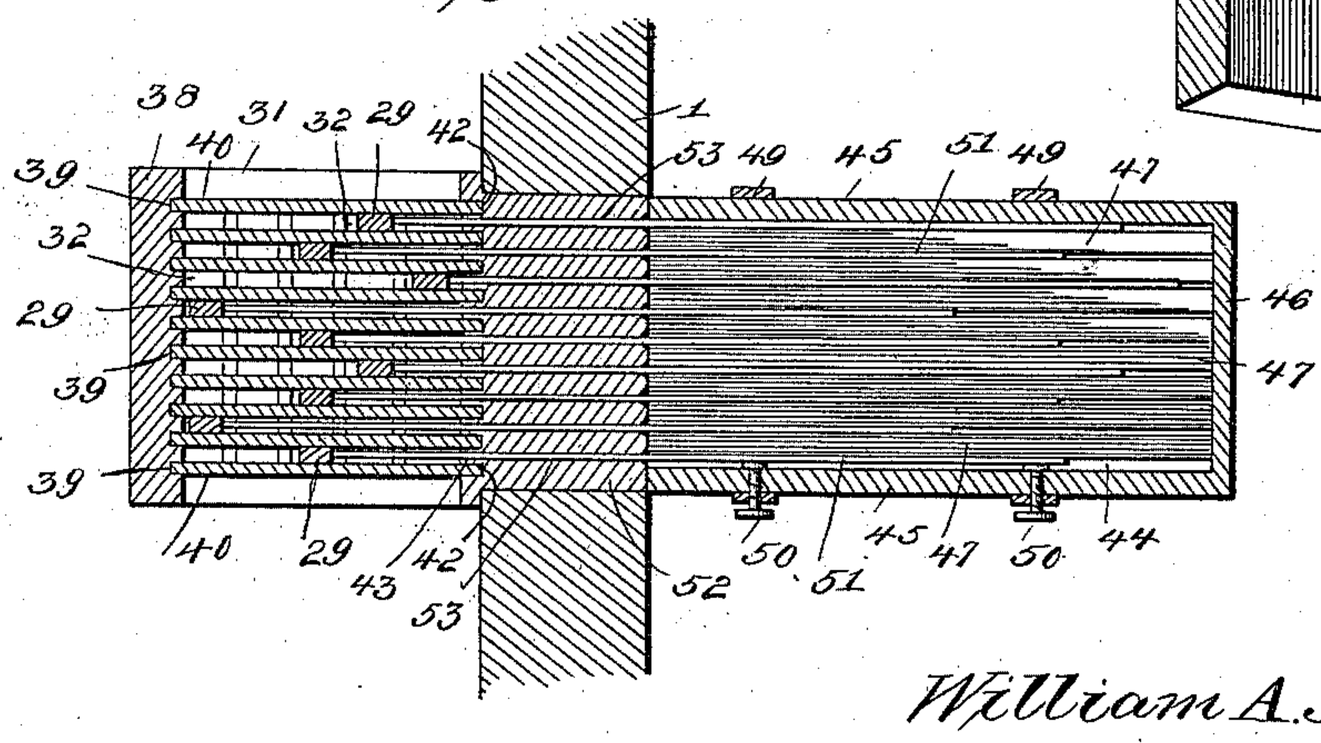
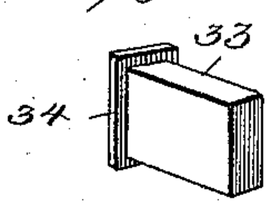


Fig. 9.



Inventor

William A. Johnston,

Witnesses

John C. Shaw

J. F. O'Riley

By his Attorneys.

C. A. Snow & Co.

(No Model.) 2 Sheets—Sheet 2.

W. A. JOHNSTON.

LOCK.

No. 558,649. Patented Apr. 21, 1896.

Fig. 2.

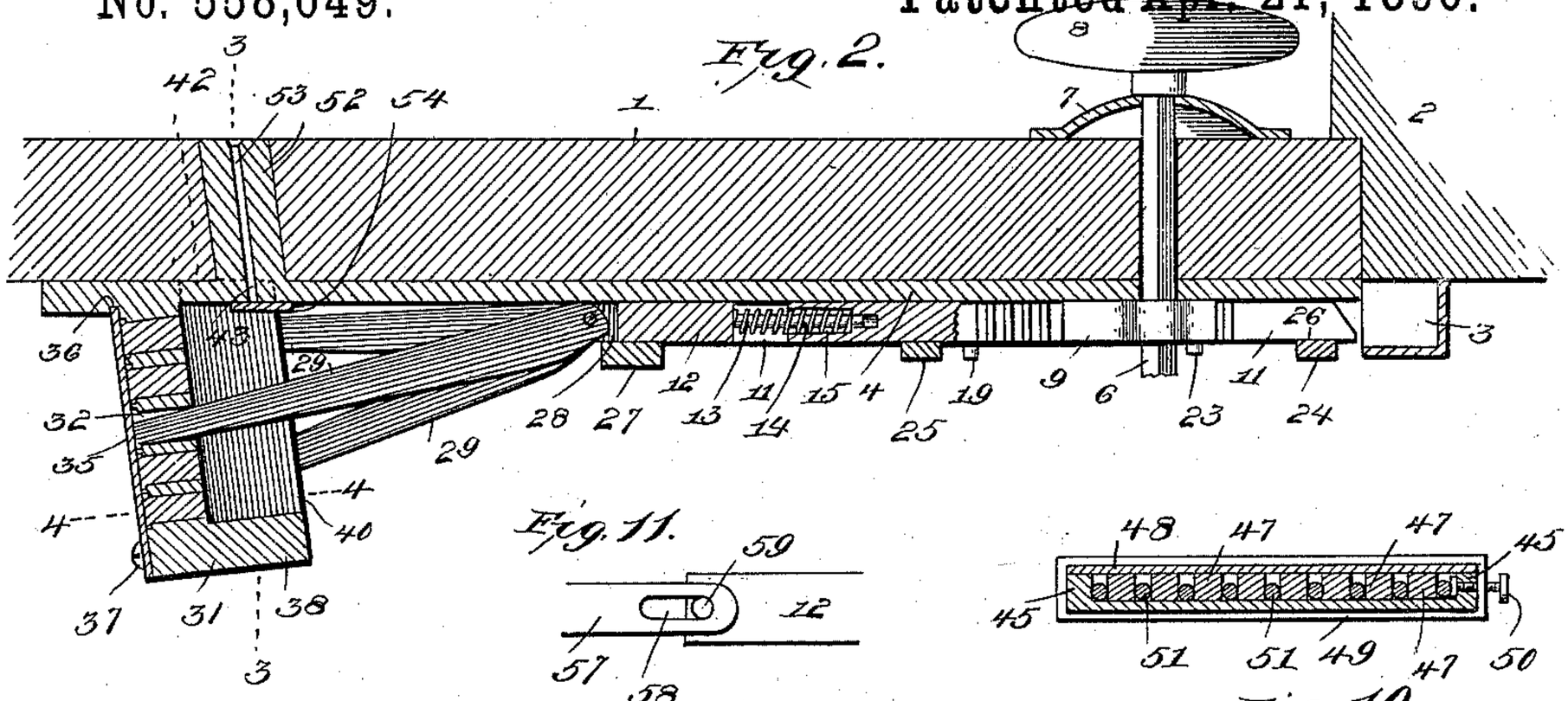


Fig. 11.

Fig. 10.

Fig. 4.

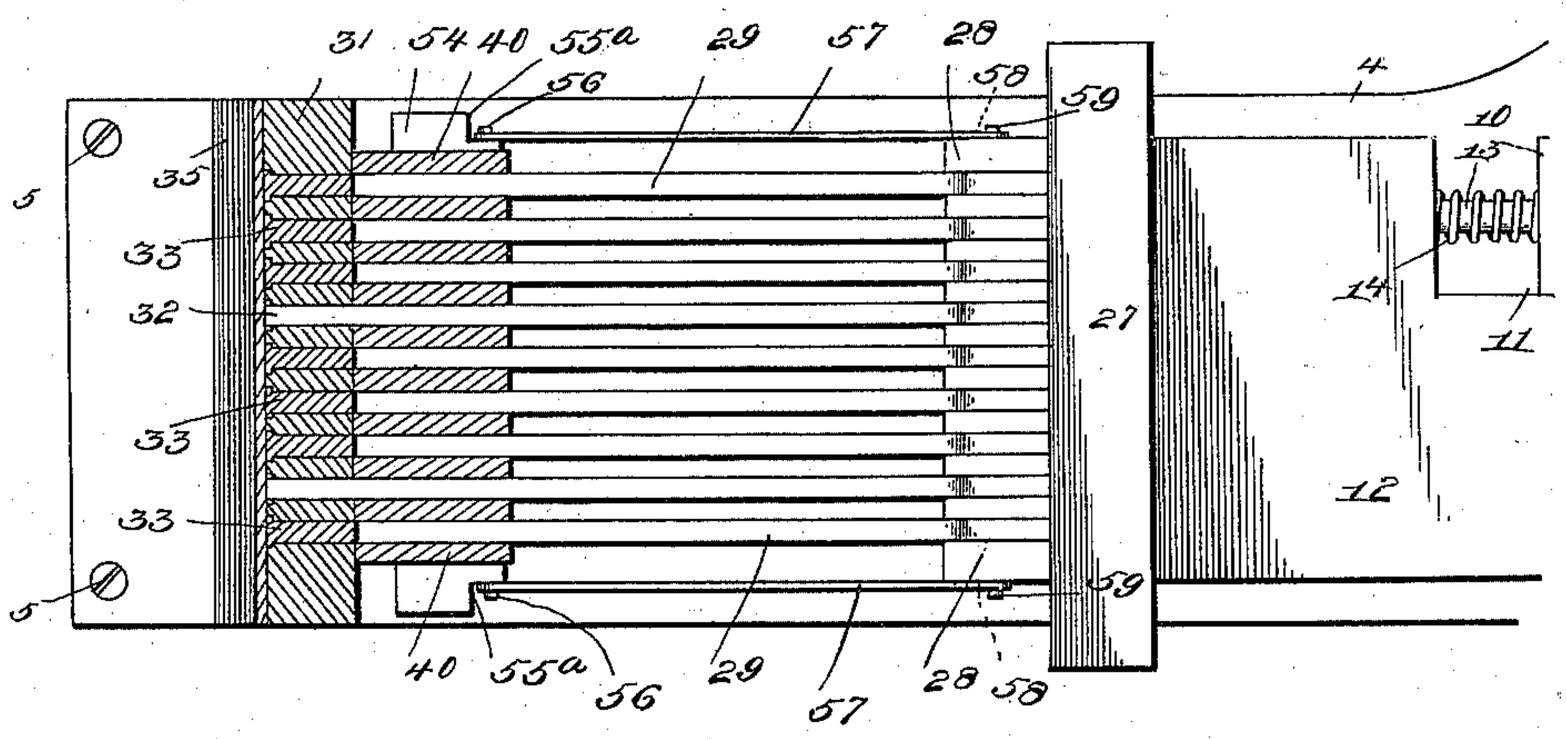


Fig. 6.

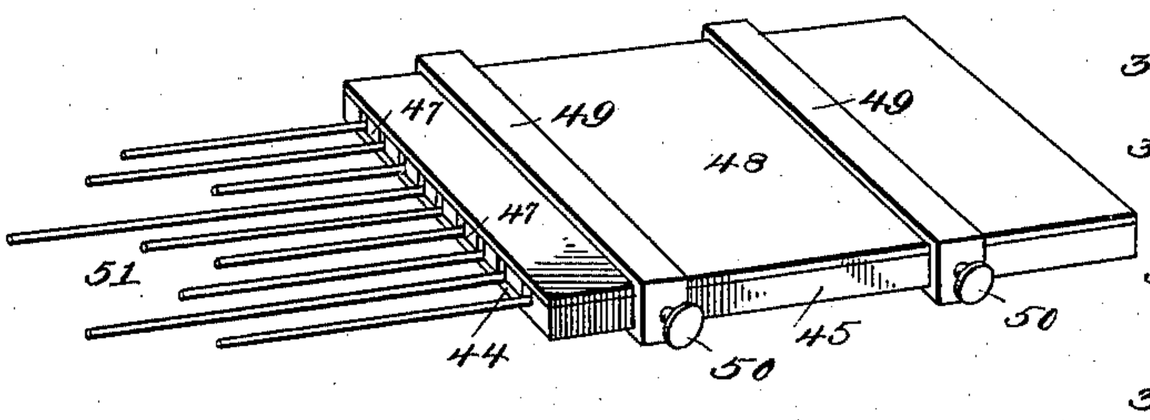


Fig. 8.

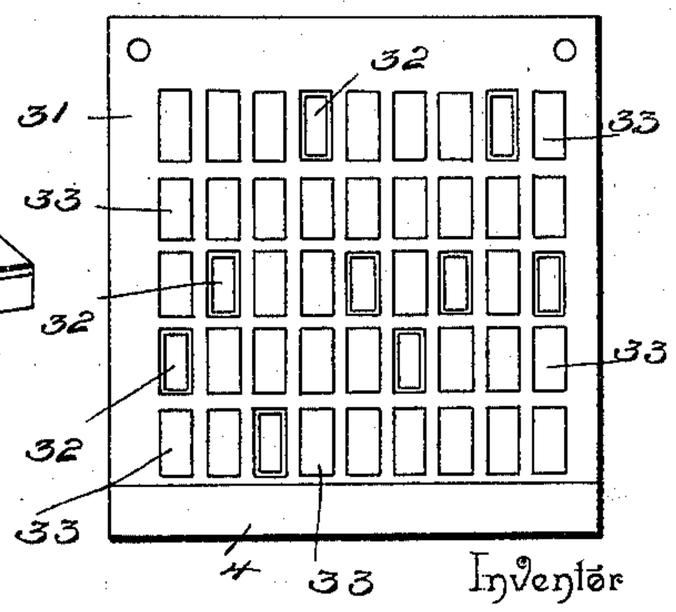
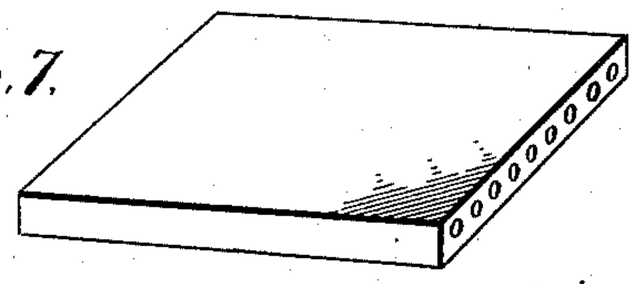


Fig. 7.



Witnesses

John C. Shaw

J. F. J. Riley

Inventor

William A. Johnston,

By his Attorneys.

C. A. Snow & Co.

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

WILLIAM A. JOHNSTON, OF WYTHEVILLE, VIRGINIA.

LOCK.

SPECIFICATION forming part of Letters Patent No. 558,649, dated April 21, 1896.

Application filed June 8, 1895. Serial No. 552,139. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. JOHNSTON, a citizen of the United States, residing at Wytheville, in the county of Wythe and State of Virginia, have invented a new and useful Permutation-Lock, of which the following is a specification.

This invention relates to an improved permutation-lock wherein the bolt has connected thereto a series of swinging fingers, which move therewith and which are adapted to pass into openings of the lock-frame, so that their rearward movement may be permitted and so that the bolt may move in the performance of its function.

The invention is particularly adapted for use in connection with the doors of dwellings and other houses, though it may be well applied to safes and storage-vaults, as other locks of its class.

In the drawings, Figure 1 is a perspective view of a permutation-lock constructed in accordance with this invention. Fig. 2 is a longitudinal sectional view of the same. Fig. 3 is a sectional view on line 3 3 of Fig. 2. Fig. 4 is a sectional view on line 4 4 of Fig. 2. Fig. 5 is a detail view illustrating the construction for connecting the two bolts. Fig. 6 is a detail view of the key. Fig. 7 is a similar view of the cap of the key. Fig. 8 is a detail view of the plate or block which receives the pivoted fingers. Fig. 9 is a detail view of one of the removable blocks or plugs. Fig. 10 is a transverse sectional view of the key. Fig. 11 is an enlarged detail view illustrating the construction of the links which connect the bolt with the movable plate for covering the keyhole.

The reference-numeral 1 indicates the door, which is here shown to be that usually employed in connection with dwellings, and 2 the frame of the door. The frame of the door is provided with a keeper 3, with which the bolt of my improved lock operates. The lock of my invention comprises a main plate 4, upon which the moving parts of the device are mounted and which comprises the bed or base thereof. This plate is adapted to be rigidly secured to the inner side of the door 1 by means of screws 5, which pass through it and into the door, as may be seen by reference to the drawings.

6 indicates a spindle, which passes through the door 1 and which is revolubly mounted in a box 7, secured to the outer side of the door 1. The spindle 6 is provided with knobs 8, similar to those usually employed, and is rocked or oscillated to operate the door, as will be explained more fully hereinafter.

Fixed to the spindle 6 and lying directly against the inner side of the main plate 4 is the sector 9, which has its curved face provided with cogs, and these cogs mesh with corresponding cogs formed on the upper side of the section 10 of the bolt. The section 10 of the bolt is extended horizontally and seated in a recess 11 of the main part 12 of the bolt. This main part 12 of the bolt is of a thickness equal to that of the section 10 and lies snugly against the same.

The shoulder at the rear or outer end of the recess 11 is provided with a longitudinally and horizontally projecting pin 13, which carries an expansive spiral spring 14. The pin 13 is seated within a longitudinally-extending passage 15, formed in the rear end of the section 10 of the bolt. This permits the section 10 to move independently of the part 12, while the spring 14 gives the section 10 a tendency outward. This tendency when not restrained causes the section 10 to project beyond the section 12, and in order to hold said section in vertical alinement the section 12 is formed with a dovetailed depression 16 in its inner side. In this depression a dovetailed plate 17 is arranged and made capable of having movement therein. The depression opens at the upper edge of the part 12 of the bolt, so that the plate 17 will be capable of passing into a correspondingly-shaped depression 18 in the section 10. The depression 18 is practically a continuation of the depression 16, and when the plate 17 is moved to lie snugly in each the two sections of the bolt will be connected to each other, so as to render their independent movement an impossibility. It will be understood that the spring 14 will operate to press the section 10 outwardly, causing it to bind against the plate 17 thereof, holding said plate from useless play and from consequent displacement. 19 indicates a button, which is fixed to the plate 17, and which is provided to facilitate moving the same.

In the lower edge of the plate 17 and pro-

jecting downwardly therefrom is a spring-arm 20, which has its lower end curved slightly outward and which has a normal tendency that will cause it to forcibly engage the lower portion of the part 12 of the bolt when the plate 17 has been moved so as to permit this engagement. Fixed to said portion of the section 12 is the stud 21, which projects outwardly therefrom and which is adapted to be received in a recess 22, formed in the arm 20. Thus it will be seen that upon moving the plate 17 downwardly, so as to lie completely in the depression 16 and so as to be disengaged from the section 10, the stud 21 will operate to engage with the arm 20, and thereby hold the plate 17 from useless movement.

In order that the outward movement of the bolt may be properly limited, the section 10 thereof is provided with a stud 23, which projects out horizontally from its inner side and which is adapted to engage with the guide-bar 24 when the bolt moves outwardly beyond the predetermined point. 25 indicates a second guide-bar, which is fixed to the main plate 4 and which, like the bar 24, is formed with an opening 26, through which the bolt passes and in which said bolt may have that movement which is essential to its effective operation.

The section 12 of the bolt rearward of the shoulder which carries the pin 13 is enlarged, and this enlarged portion is passed through a correspondingly enlarged opening in the guide-bar 27. Formed in the extremity of the section 12 are the short longitudinal slots 28, which are preferably nine in number and which extend parallel with each other and in close relation thereto, their outer ends being in communication with the rear end of the said section 12. 29 indicates the fingers heretofore referred to, and these are one for each slot 28 and have their front ends pivotally mounted in respective slots by means of the vertically-extending pin or spindle 30. The pin or spindle 30 passes through the rear end of the section 12 and through the finger 29 and pivotally mounts the same in place, all of which will be apparent.

The front extremities of the fingers 29 are slightly reduced in width, and just outward of the rear end of the section 12 this width is increased to a thickness considerably greater than the thickness of the section 12. Thus, as this section 12 is moved forwardly the widened portions of the fingers 29 will engage with the guide-bar 27, whereupon said fingers will be forced to move inwardly and to lie snugly against the plate 4. From these enlarged portions and upward to the free and rear ends of the fingers 29 the same decreases in width until they assume a width equal to about one-half the width of the widened portions.

Rigidly secured to the rear portion of the plate 4 by any suitable means is the plate or block 31. This plate has formed therein forty-five square openings 32. These openings are arranged in five horizontal lines of nine each and extend entirely through the block from the front to the rear side thereof.

33 indicates thirty-six small blocks, which are capable of fitting within the several openings 32, and which will completely fill the same. Formed integral with the rear edges of the blocks 33 are the flanges 34, which project outwardly therefrom, and which are adapted to fit within corresponding rabbet grooves formed around the outer edges of the openings 32. By these means the openings 32 may be filled, so that the front face of the block 31 will be smooth and unbroken and so that the rear face will be equally smooth.

Lying against the rear side of the block 31 is the plate 35, which is of a size equal to that of the block 31, and which is arranged with its lower end within a groove 36 formed in the inner side of the plate 4. By these means the plate 35 may lie snugly against the rear side of the block 31, and in order to hold the upper end of the said plate 35 secure the same is provided with screws 37, which pass through it and into the block 31. By these means the small blocks 33 are prevented from being removed from their several openings 32.

The purpose of the block 31 and its subordinate blocks 33 is to form openings in the block 31 in which the rear ends of the fingers 29 may be passed, and to make it possible that these openings may be changed when the necessity of such an operation arises and whereby the "combination" of the lock will be changed. Thus by providing thirty-six of the blocks or plugs 33 all of the openings 32 may be filled with the exception of nine, which leaves one unfilled opening for each finger 29. These unfilled openings will occur one in each vertical line of the openings 32, so that the fingers may be moved to insure their entrance into the same. If the fingers are so adjusted that they will pass into these openings, it will be possible for the bolt to move rearwardly, so as to permit its disengagement from the keeper 3; but, on the other hand, if the fingers or any one of them are not so adjusted the rearward movement of the bolt will be an impossibility and the lock cannot, therefore, be released.

Formed integral with or rigidly secured to the upper end of the block 31 and projecting therefrom is the ledge 38, which is of a length equal to the size of the block 31, and which has rigidly secured in grooves 39 the guide-plates 40. The grooves 39 are ten in number and are arranged parallel with each other and on the under side of the ledge 38. The guide-plates 40 proceed downwardly from the ledge 38 and parallel with each other, and have their lower ends seated within slots 42, formed in the plate 4. These plates are secured in position by screws or any other fastening device, and must be rigid in order to secure the proper operation of the device.

Each of the fingers 29 projects through the space inclosed by the plate 40, and these

plates permit the fingers to be moved upwardly in order that their rear ends may reach the unfilled openings in the block 31.

Formed in the plate 4 and in the space between the slots 42 are the openings 43, which are nine in number and which are arranged in a transverse line, so that one opening will be directly adjacent to each finger, so that an instrument passed through the said opening will engage with the respective fingers and move them outwardly to an extent limited by the ledge 38. These openings are provided for the passage of the needles forming part of the key for use in my invention. This key will now be described.

44 indicates a base-plate which has formed integral with or rigidly secured to one side thereof the flange 45. This flange extends throughout the length of the base-plate. Located at the rear end of the base-plate 44 is a second flange 46, which is practically a continuation of the flange 45, and which is also formed integral with or rigidly secured to the plate 44.

47 indicates a series of bars, which are nine in number, and which are of a thickness equal to the flanges 45 and 46. These bars have a length commensurate with that of the plate 44 and are arranged thereon, so as to be capable of moving toward or from each other. A plate or cover 48 is arranged over the upper sides of the bars 47 and rested upon the outer edges of the flanges 45 and 46, whereby the bars are held in proper relative positions. Embracing the whole of this arrangement and extending across the same are the loops 49, which are two in number, and which lie snugly against the cover 48 and plate 44, and are provided with set-screws 50. These set-screws 50 are so located that they will be capable of engaging the intermediate bar 47 at that side which is opposite the side bearing the flange 45. Thus by moving up the screws 50 the several bars 47 may be caused to forcibly engage with each other. The actual engagement of the bars 47 is prevented, however, owing to the fact that the needles 51 are arranged within the space inclosed by said bars 47. These needles are nine in number and are formed of rigid steel rods of the same length. The purpose of this construction just described is to permit the adjustment of the needles or rods 51, so that their outer ends may be arranged in the desired transverse planes. Thus, by reference to the views of the drawings which illustrate this part of my invention, it will be seen that the several needles are all arranged with their outer ends out of alinement with each other, and it may be explained that this arrangement of the needles is subject to the location of the unfilled openings 32 in the block 31.

The purpose of the key, or that device which has just been described, is to move the fingers 29 outwardly to the proper position, which will be that which permits said fingers to enter the unfilled openings, and to do this the needles 51 are inserted into the respective openings 43, so that they will engage with the fingers and move them outwardly, and this outward movement will be limited by the length of the needles, or rather the length which said needles can project into the space inward of the plate 4. All that is necessary, therefore, to the adjustment of the fingers is to insert the needles 51 into the openings 43 as far as the plate 44 will permit. It will be seen that the needles will be adjusted by loosening the set-screw 50, and that they are secured upon tightening the same, all of which has been explained before.

The openings 43 are in communication with the outer side of the door by means of the block 52, which may be either rigidly secured to or formed integral with the outer side of the plate 4, and which projects through the opening in the door. This block is perforated in conformity with the opening 43, so as to form a continuation thereof, and the upper end of the block projects to the outer side of the door 1. The perforations or passages in the block 52 are designated by the numeral 53, and the outer end of these passages are enlarged or flared to a slight degree in order that the needles may be easily inserted.

I have provided means whereby the tampering with the lock is prevented, and whereby it is made an absolute impossibility to open the same without an accurate knowledge of the combination existing in relation to the opening 32. These means consist of a plate 54, which is of a width equal to a little less than that of the rear end of the plate 4, and which is arranged to slide in the slots 55 formed in the lower ends of the guide-plates 40. This plate is capable of, by reason of the location of the slots 50, covering the openings 43, and it is for this purpose that the plate 44 is provided. Projecting out laterally from the rear corners 55^a are the studs 56, which are one in each corner, and which have pivotally connected thereto the links 57. These links are one for each of the studs, and project forwardly and parallel with each other to the rear end of the section 12 of the bolt. The front ends of the links 57 are formed with longitudinal elongated slots 58, and these slots are provided to receive the studs 59 of the section 12, said studs being one for each slot, and fitted within the same, so as to be capable of stroking throughout their length, and of moving independent of the links subject to the length of the slots.

In the operation of the lock it will be necessary to first move the bolt rearwardly for a distance sufficient to place the front ends of the fingers 29 rearward of the guide-bar 27, else said fingers will bind against the guide-bar in their outward movement. Supposing, therefore, that this rearward movement of the bolt has been effected, the plate 55 will be moved to an opening just forward of the opening 43. It will be understood that upon the first movement of the bolt the studs 59

will move through the slots 58 and have no effect upon the links 57. When, however, the studs 59 engage with the rear extremities of the slots 58, the links 57 will be no longer inactive, but will move rearwardly, causing the plate 54 to take a similar movement and to lie just forward of the opening 43, as has been explained. The parts are now in position to permit the insertion of the needle 51 of the key, and when this has been done the fingers 29 will be moved outwardly, so that it will be possible for them to pass into their respective unfilled openings 32. When this stage of the operation has been reached, the key should be withdrawn, and the operation of unlocking completed by moving the bolt rearwardly until disengaged from the keeper 3, it being understood that the fingers 29 move into the unfilled openings 32 to permit this rearward movement of the bolt.

Now the usefulness of the plate 54 and its attending parts may be explained as follows: By carefully following the operation of the parts it will be seen that the plate 54 is located directly forward of the openings 43 when the ends of the fingers 29 are a short distance from the openings 32. Now when the fingers begin their second movement and enter the openings 32 the plate 54 will be moved to cover the openings 43, thus making it impossible for an instrument to be inserted in said openings, and the plate remains over the openings 43 so long as the ends of the fingers 29 are located within the openings 32 or a short distance forward thereof. By this it is impossible for a person to test and to experiment with the lock until the proper combination has been found, for no sooner will he have one finger adjusted at what he proposes to try, if it is the proper adjustment, than the plate 54 will cover the openings 43 and render the adjustment of a second finger impossible until the plate has been removed, which removal will be attended by a forward movement of all of the fingers 29 and a consequent displacement of the principal finger referred to above. Thus it will be seen that the only way by which the lock may be surreptitiously opened is to adjust every finger at the same instant and, of course, in the proper manner, and it is needless to say that this can only be done by a certain knowledge of the combination, for, while perhaps it is a possibility, it is most improbable that any person could guess the specific location of each unfilled opening at the same time and without any experience in regard thereto.

In the use of my invention the plate 4 with its attachments is secured to the inner side of the door, so that the bolt may engage with the keeper 3, all of which is well illustrated in the drawings, particularly Fig. 1. No further description of the lock will be necessary, and it will be sufficient for me to say that the section 10 of the bolt is made independent from the main section 12 in order that it may be used as an ordinary latch, and this use is effected by disengaging the plate 17 from the section 10, which will cause the said section to move forwardly under the influence of the spring 14 and destroy all positive connection which it had with the main part 12. It will now be possible to reciprocate the section 10 by a simple rock of the spindle 6. This adjustment will be resorted to when it is not desired to employ the lock—as, for example, during the day in a dwelling-house, or when for other reasons it is not desired to lock the door. It will also be useful when a person has entered the apartment which the lock commands and is on the inner side of the door, for at such a condition of affairs it will be quite impossible for him to properly adjust the fingers 29. It will be observed that a very simple movement is necessary to connect or disconnect the bolt, which will make it easy to use and manipulate the lock. In practice it will be, perhaps, desirable to inclose the moving parts of the lock in a suitable cover or casing, all of which does not require any illustration, owing to the fact that it is well understood.

The key is provided with a cap 60, which is capable of embracing the outer ends of the needles 51 and of covering and protecting the same. This cap is held in place by means of suitable spring-catches 61, which are arranged one on either side thereof, and which are adapted to coöperate with the studs 62, fixed to the cover 48 and the base-plate 44 of the key. This device prevents the exposure of the needles 51 and makes it impossible for them to pierce the clothing of the person carrying the key. The size of the key will permit it to be readily and conveniently carried in one's pocket, and, if so desired, it may be made collapsible, so that its bulk may be reduced. This is not regarded as necessary, however.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention, such as varying the number of openings in the block and making the fingers and the key correspond with the same, providing any suitable casing to inclose a lock mechanism, and employing a latch or catch for locking the bolt 10 from the inside to prevent it from being operated from the outside, and similar changes to adapt the lock to the door on which it is to be used.

Having thus described my invention, what I claim is—

1. In a lock, the combination of a reciprocating bolt, a block located at the inner end of the bolt and disposed at an angle to the same and provided with series of recesses arranged in parallel rows, a series of fingers pivotally connected to the inner end of the bolt and adapted to enter the said recesses, and a series of removable blocks or plugs fitted in the recesses, whereby the combination of the lock may be changed by changing

the position of the removable blocks or plugs, substantially as described.

2. In a lock, the combination of a casing provided with perforations or openings 43 for the reception of a key, a block located adjacent to the openings 43 and provided with series of recesses arranged in parallel rows, removable and interchangeable plugs arranged in the recesses and adapted to vary the combination of the lock, a series of guide-plates located in advance of the recesses and forming spaces registering with the openings 43, a reciprocating bolt, and a series of fingers pivotally connected to the bolt, and having their free ends arranged in the spaces between the guide-plates, substantially as described.

3. In a lock, the combination of a casing provided with openings 43, a reciprocating bolt, a block located adjacent to the openings 43 and disposed at an angle to the bolt and provided with recesses arranged in parallel rows, removable and interchangeable plugs arranged in the recesses and adapted to vary the combination of the lock, a series of fingers pivotally connected to the bolt, and a key comprising a body and a series of parallel longitudinally-adjustable rods adapted to fit in the openings 43, substantially as described.

4. In a lock, the combination of a casing provided with openings 43 for the reception of a key, a reciprocating bolt, a block located adjacent to the openings 43 and provided with recesses and having removable plugs arranged in some of the recesses, fingers pivotally connected to the bolt and adapted to enter recesses of the block, the plate 54 located adjacent to the openings 43, links 57 pivoted to the plate 54 and provided with slots, and fastening devices arranged in the slots and mounted on the bolt, substantially as and for the purpose described.

5. In a lock, a key comprising a base-plate provided with side flanges, a series of bars arranged parallel and loosely disposed on the base-plate, rods 51 arranged between the said bars, a cover arranged on the bars and the side flanges of the base-plate, loops receiving the base-plate and the cover, and clamping-screws mounted on the loops and engaging the adjacent bar and securing the rods 51 at the desired adjustment, substantially as described.

6. In a lock, the combination with a frame or casing provided with a series of openings, a reciprocating bolt, a block located at the inner end of the bolt arranged substantially at right angles thereto and provided with a series of recesses located at different distances from the said openings, and a series of fingers pivotally connected to the inner end of the bolt disposed longitudinally thereof adjacent to the said openings and adapted to enter the recesses of the block when alined with the same to permit the bolt to be retracted, of a key comprising a body, and a series of longitudinal rods or needles projecting from the body and adapted to engage the pivoted fingers to cause the latter to aline with the said recesses and capable of adjustment to cause the fingers to aline properly with the recesses, substantially as and for the purpose described.

7. In a lock, the combination of the bolts 10 and 12 arranged contiguous to each other, a spindle provided with means for actuating the bolt 10, and a catch mounted on one of the bolts and adapted to connect the two bolts, whereby the spindle may be employed to reciprocate both bolts or only the bolt 10, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

WILLIAM A. JOHNSTON.

Witnesses:

JAS. W. SHEFFEY,

J. P. HILL.