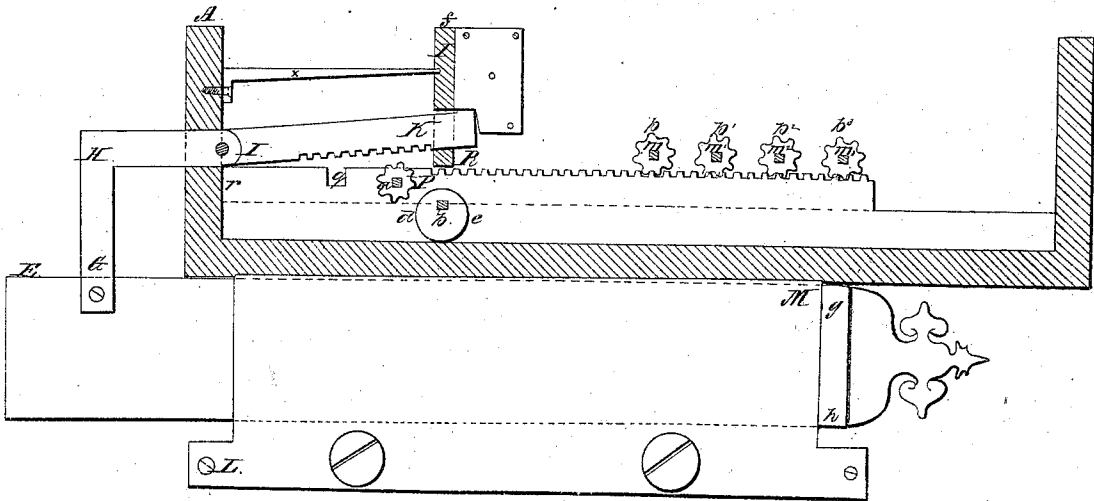
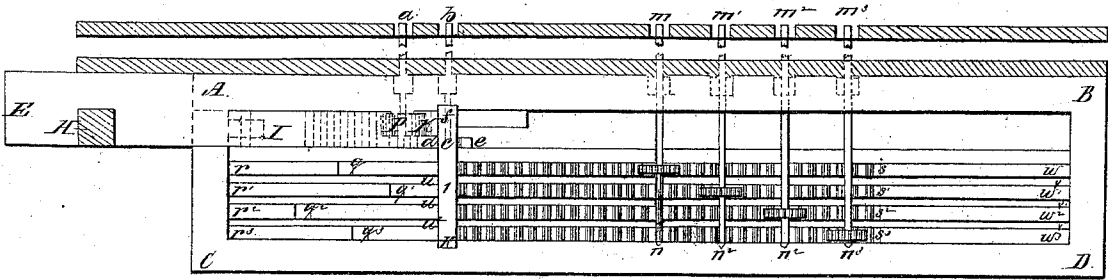


*F. W. Alexander,
Lock.*

N^o 32,171.

Patented Apr. 30, 1861.



*Witnesses:
McLum's Sons
J. C. Ball*

*Inventor:
F. W. Alexander*

UNITED STATES PATENT OFFICE.

FREDERIC W. ALEXANDER, OF BALTIMORE, MARYLAND.

COMBINATION-LOCK.

Specification of Letters Patent No. 32,171, dated April 30, 1861.

To all whom it may concern:

Be it known that I, FREDERIC W. ALEXANDER, of the city of Baltimore and State of Maryland, have invented a new improved apparatus for securing fast and reopening at the pleasure of the owner alone the movable portion or door of safes of every description, boxes, warehouses, and dwelling-houses, and in general all receptacles for valuable articles, usually termed a "lock;" and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings; and to the letters of indication marked thereon.

These drawings are two in number, one being an orthographic projection of the apparatus as seen when looked down upon from above and the other is partly a projection and partly a section of the important portions of it in a vertical plane.

The same letters of course indicate the corresponding parts in each.

A. B. C. D then is an oblong box of wrought or cast iron or other metal of suitable size to contain the requisite machinery according to the purpose for which it is intended; for it is of the essence of this invention of mine that it may be applied in form and substance as well to the most delicate as to the most cumbersome construction.

E. F. is the bolt which when shot is the principal fastening, and is also the prime mover in any system of tangle bolts or other contrivance for shooting or sliding other fastenings, on the same or other edges of the door. Such a system whereby the number of fastenings may be increased to eight, (the resistance of the door to any forcible opening being thereby proportionably augmented,) and which I prefer, and recommend for the doors of large safes, or vaults, wherein treasure is deposited, I do not introduce into the present description, being advised that either it cannot be made the subject of a patent at all, or it should be patented upon a separate application. Motion is communicated to this bolt through the clutch or arm G H I K (shown especially in the vertical section) which may or may not be permanently fastened to the body of the bolt itself. In either case the portion G H, which when the bolt is drawn back abuts against the face A C of the lock, prevents any further motion in that sense, while a

projecting rabbet *g, h*, either worked solidly out of or artificially applied to the hinder portions of the bolt, answers a similar purpose when the said bolt is being shot outward of arresting motion in that sense also, by abutting against the strap L M that otherwise fastens, and preserves the parallelism of the bolt with the inner surface of the door. The upper member of this clutch which passes through the appropriate side of the lock-box is jointed within and racked on its lower face so that when in gear it engages with the pinion P the revolution of which pinion is effected by a key applied to the shaft or arbor P. *a*. When not in gear (as is always the case when the door is locked) the said pinion whose gudgeon (*a*) may be regarded as the nipple of the principal keyhole of the apparatus, is altogether detached from the bolt—revolves idly with the key—and furnishes no sort of indication of the existence or relation of the interior machinery and thus one of the most important points in the construction of an inscrutable lock viz the independence of the bolt—is secured. The throwing in or out of gear of this member is effected by means of another arbor *b, c*, whose nipple counter-sunk in an adjoining and similar keyhole with the other, and fitted by the same key, bears near the end of its journal inside an eccentric circular wheel *d. c.* when in the revolution of said arbor *b. c.* the eccentricity of the wheel *d. c.* comes uppermost, the edge of said wheel, which shortly comes in contact with the lower face of a metallic plate F. I. K. (on the orthographic projection and F. K. on the vertical section) gradually lifts said plate, until when the eccentricity of said wheel has reached the culminating point, the lower edge of the plate itself is clear of the other sliding parts of the machinery to be presently spoken of. A recess,—(cut in the edge of said plate lying at right angles with the lower edge)—allows the passage through, by it, of the end of the racked limb I. K, which rests upon the lower shoulder of such recess near $\frac{1}{2}$ and which as said shoulder is elevated, is also itself lifted, likewise and the rack thus disengaged, from the pinion P. This plate F. I. K. may be considered as the real stop or lock of the whole apparatus. So long as it remains up the bolt and its connected system of fastenings are entirely motionless in any direction as I. K then abuts against a pro-

jection in the side of the case which it slips under when F. I. K is allowed to fall, allowing the bolt to move backward only when F I K is down. It is also inaccessible either to the normal key for opening the door or to any other implement fraudulent or forcible short of what can break down the solid door. If the existence and application of such implements be assumed all locks or fastenings are useless equally—while in the logical theory of the problem it is admitted by common sense that no lock need transcend the resistance of the material composing the door within which it is placed. It is only necessary therefore in this particular that the thickness of the plate F. I. K be sufficient to resist any bending which the weight of the apparatus might cause—so that it may play straight up and down. Otherwise such thickness is at discretion. Farther this stop cannot descend until by the intelligent arrangement of the several other sliding portions of the machinery to be presently described a suitable recess or continuation of recesses has been established immediately under it or in the same plane with it into which it can fall. These recesses are shown in the drawings at p for the vertical section and $p' p^2 p^3$ for the other. They are cut in each of the several slides $i s. i' s' i^2 s^2 i^3 s^3$ at different and within certain limits arbitrary points of the same, of a depth equal to that of the shoulder k before mentioned and of a width which will just admit the thickness of that shoulder which is the same as that of the plate itself. The metal of which these slides are composed is not material farther than that its hardness as well as that of the top plate F I K diminish the wear and tear and tend to maintain longer and in a higher degree the refinement of the adjustments upon which in part the security of the arrangement and the inscrutability of the lock depend. Motion and fro is communicable to these slides by means of arbors, $m n, m' n', m^2 n^2, m^3 n^3$, having nipples countersunk in keyholes on the face of the door, in all respects similar and equal to those at a and b . These arbors bear the pinions $p p' p^2 p^3$ which are always engaged in the racked portions of the slides. This racking should extend over about $\frac{3}{4}$ of the face of each slide, and should be of the same length in each, as every other dimension should be, for a reason which will presently appear.

The slides exhibited in the drawings are four in number that being quite enough for any purpose practically. If there were but a single slide with its recess as aforesaid, the chances of an adjustment of said recess to the stop-plate by a person ignorant of the opening number but endeavoring to find it by trial, would be proportioned to the play of the stop plate in the recess (not over

1-100 inch) and the length of motion allowed to the slide. If there be two slides such chance would be in the duplicate ratio or square of such proportion, and so on. A quadruplicate such as is given by four slides is thus seen to raise such unfavorable chances practically to infinity. Nevertheless though the existence of plural slides is of the essence of the combining feature of my invention their precise number is matter of discretion in each and every case.

On the face of the door, and around each of the keyholes $m m' m^2 m^3$, are circular disks of metal suitably perforated whose limb is graduated (the number of divisions being a matter of discretion) and which—held in their places by certain pins in their circumference, whose number is at discretion, or by grooves in their countersunk collar, adapted to corresponding ones in the door—allow of being removed so as to change whenever desired the zero of the graduation, for a purpose presently to appear. The key is a mere barrel like that for a common clock, the handle or cross-head of which serves as an index to the graduation, or the key itself may be a flat disk bearing the graduation as in the model herewith presented—only with a movable limb whereby the zero of graduation may be changed at any time—or this precaution only of avail or use against treachery of clerks &c. knowing the combinations—may be dispensed with. All the nipples are of the same size and the same key turns the pinions and the eccentric and the bolt. Assuming then the zero to be fixed at any time, the person authorized to open the lock needs only before locking it to open the lid and observe what division on the graduated limb or limbs aforesaid corresponds respectively with that position of the pinions and slide, which brings the recess in adjustment with the stop-plate, and thus allows the former to be entered by the latter—the jointed limb I K to become engaged with the pinion P and the bolt to be capable of being moved. Of course if no alteration be made on the zero any subsequent adjustment to the same reading or readings will restore the adjustment of recess and stop-plate.

For the purpose of still further intensifying the inscrutability of the lock and of defying not only the fraud of persons outside but the possible infidelity of persons inside who may be trusted with a knowledge of the numbers, two additional provisions exist, capable of being used either together, or separate. One is the capacity of any of the slides for being removed from their usual places defined by the longitudinal ribs $u v u' v^1 u^2 v^2$ extending the whole length of the box and being interchanged, thus presenting an entirely new set of readings. This may be done by hand in a few minutes.

Thus any amount of familiarity with the combination numbers before such interchange is utterly at fault thereafter. The other is the dropping into one or more of the grooves in which the slides work at w , w' , w^2 , w^3 , and at the opposite end small parallelepipeds of metal (divers of which may be furnished with the lock,) which restrict the scope of motion in the slides, and change their actual zeros, a corresponding change being made at the same time upon the graduation of either the keyhole or key (which-ever method of reading may be preferred) so as effectually to exclude any clue to the amount of dislocation which has been made, and render the old readings, with which a person striving to open the lock may have become acquainted, entirely useless. After the use of either of these contrivances the maker of the lock becomes as ignorant of the secret as the most utter stranger. Indeed if the recesses in the several slides are left to be filed (an operation of a few minutes) when the lock is purchased the owner will alone know the secret. Finally X shows a metallic spring pressing the plate F I K against the movable slides.

The foregoing description being understood the mode of working the apparatus becomes simple. The door being open and the lid thrown back the slides are moved by hand until their several recesses admit the stop-plate. The clutch of the bolt is then in gear and by the key at (a,) the bolt is movable. The graduated limb or limbs (in the keyholes or key as aforesaid) are adjusted so as to read any number which may be adopted for each, (or taken as they come up, by chance, the first time.) The lid is then dropped the door closed, and the bolt shot. The key is next applied to the nipple b, the eccentric turned and the stop-plate lifted. Then with the key successively at p p' p^2 p^3 the several slides are moved backward or forward to any distance and the apparatus remains locked until the same numerical readings at the keyhole are reproduced successively. With the model handed in here-with the chances are more than five hundred million of millions to one against such reproduction with a party ignorant of the numbers.

It will be manifest, then, from what precedes, that the novelty and peculiarity of my invention consist in the following points, viz:

1st, the independence of the bolt when shot from any and all parts of the machinery, which (machinery) is then capable of being revolved or moved in any manner. I

am aware of similar independence having been secured in existing contrivances but in none so simply as I think—so strongly as will be apparent—and certainly not by any in manner the same.

2d, the combination of slides moving rectilinearly, substantially as I have described—whether these slides be more or fewer and whether motion be communicated to them through one shaft or (as I have preferred both for greater intelligibility and economy in construction) through several—whether by one pinion or by several, and whether without any pinion at all, by a screw or lever, or some other of the several manners, in which motion of the kind, and in the direction desired, is capable of being effected.

3rdly, the permutations of these slides and their capacity for interchange substantially in the way which I have described, whether such interchange be effected by the hand or collateral machinery—and the thereupon consequent capacity for change of actual zeros in the "suite" of numbers used for combination.

4th, the permutations of the nominal zeros of said numbers with the aid of separate detached pieces of metal, and effected substantially as I have described, whether the same be by graduated limbs affixed in any suitable manner to the keyhole or by a graduation on the key or opening implement.

5th, the inaccessibility of the apparatus as I have described by its position—to any fraud or force, less than what will break through and destroy the door (which may be of any thickness) within which it is affixed.

6th, the security afforded against gun-powder if even that article could possibly be introduced (by drilling through the door or hardened steel pinions) whether the same security be by the loose or hinged lid, or by the absence of any lid whatever.

Now, what I claim as my invention and ask to be secured by Letters Patent, is—

1. The apparatus for detaching the bolt when shot, from the ordinary machinery of the lock, substantially as I have described.

2. The apparatus of combinatory and interchangeable slides, moving rectilinearly, substantially as I have described; and

3. The use of separate pieces of metal at w , w' , w'' , w''' , etc., in connection with the said slides, for the purpose which I have set forth.

F. W. ALEXANDER.

Witnesses:

J. L. ALEXANDER,
E. F. DALRYMPLE.