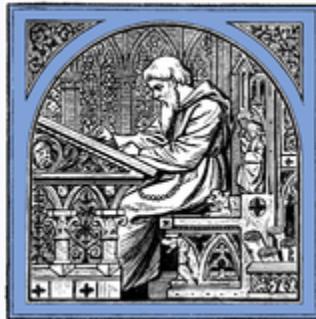


A Dissertation on the Construction of Locks

Joseph Bramah



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A
DISSERTATION
ON THE
CONSTRUCTION
OF
L O C K S.

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CONTAINING,

FIRST—Reasons and Observations, demonstrating all
LOCKS, which depend on FIXED WARDS, to be
erroneous in Principle, and defective in Point of
Security.

SECONDLY—A Specification of a Lock, constructed on a
new and infallible Principle, which, possessing all the
Properties essential to Security, will prevent the most
ruinous Consequences of HOUSE ROBBERIES, and be a
certain Protection against Thieves of all Descriptions.

BY JOSEPH BRAMAH.

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A
DISSERTATION, &c.



THE protection and preservation of life, and property, are objects which have been anxiously, and necessarily attended to in the most harmless states of society. The art and invention of ingenious men have in all times been applied to contrive means of security adapted to the particular dangers to which either life or property were exposed, from the nefarious practices of the day. A review of their productions, which we must presume to have been effectual to their purpose, suggests a conclusion, that the morals of former times, were as much less depraved than those of the present, as the mechanical contrivances for security were less excellent; and the progress of a disposition to rob, and defraud, may perhaps be more accurately traced in the works of art that were formerly used for security and defence, than on any other principle, or ground of reasoning. It is certain, however, that no invention for the security of property hath yet been offered to the world, which the ingenuity of wickedness hath not found means to defeat; nor is it probable that the genius of any one man will ever strike out a method, by which all the arts and manœuvres, which are practised in the science of robbing, may be effectually counteracted.

Modern degradation is reduced to a system, in which art and force are exerted with such skill and power, as to elude precaution, and to defy resistance. The dread and anxiety, which every inhabitant of the metropolis and its environs, must feel in the reflection that he sleeps with no other assurance of safety, but the hope that chance, among the multitude of objects may direct the invaders of the night to some other victim, is an evil which cannot be contemplated without horror. Yet it is not in humanity to behold the numberless sacrifices which are made to justice, without lamenting the ineffectual severity of the law; and earnestly wishing to reduce the number of executions, by opposing methods of prevention, to the enormities which lead to such a dreadful end. It is a maxim in morals, that no man becomes at once completely wicked. The timidity which attends the first act of dishonesty, and the remorse which it excites in the unpracticed offender, are a natural, and in general a sufficient check to the commission of very enormous crimes, till the mind is tainted by evil councils, or becomes hardened by the frequent repetition of petit offences. To remove all temptation to dishonesty, and to give as few opportunities as possible to the indulgence of evil propensities, is as much the duty of those who possess, and wish to preserve their property, as obedience to the law, which forbids to steal, is the duty of those who may be tempted to deprive them of it. For the servant, who would never have meditated an attempt upon the chest which contains his master's treasure, may be tempted to purloin his purse if carelessly thrown in his way. To secrete objects of temptation, and to prevent access to them by every

possible security, seems therefore to promise more towards lessening the number of robberies, which bring daily disgrace on the police, and disturb the peace of the cities of London and Westminster, than the dread of any punishment, which the law of England can inflict.

A desire to reduce this theory to practice, induced me to apply my utmost thought and attention, to contrive an effectual impediment to the most frequent, and not the least fatal methods of robbery. It is observable that those, who are taken in the desperate occupation of house-breaking, are always furnished with a number and variety of keys, or other instruments, adapted to the purpose of picking, or opening Locks; and it needs no argument to prove, that these implements must be essential to the execution of their intentions; for unless they can secure access to the portable and most valuable part of the effects, which in most families are deposited under the *imaginary security* of Locks, the plunder would seldom recompence the difficulty, and hazard of the enterprize; and till some method of security be adopted by which such keys and instruments may be rendered useless, no effectual check or opposition can be given to the excessive, and alarming practice of house-breaking.

Being confident that I have contrived a security, which no instrument but its proper key can reach; and which may be so applied, as not only to defy the art and ingenuity of the most skilful workman, but to render the utmost force ineffectual, and thereby to secure what is most valued as well from dishonest servants as from the midnight ruffian,—I think

myself at liberty to declare (what nothing but the discovery of an infallible remedy would justify my disclosing;)—that all dependence on the *inviolable* security of Locks, even of those which are constructed upon the best principle of any in general use—is fallacious. To demonstrate this bold and alarming proposition, I shall first state the common principles which are applied in the art of Lock-making; and, by describing their operation in instruments differently constructed, and possessing different degrees of excellence, prove to my intelligent readers that the best constructed Locks are liable to be secretly opened with great facility; and that the Locks *in common use* are calculated only, to induce a false confidence in their effect; and to throw temptation to dishonesty in the way of those who are acquainted with their imperfections, and know their inefficacy to the purpose of security.—Having dispatched this part of my subject, I shall proceed to the specification of a Lock, which by great application and expence, I have completed, and now offer to the public as a *perfect* security against every possible effort of art and ingenuity; and which I submit to the most critical investigation of curious, and skilful judges, with a confidence which assures me, that their judgement and testimony will do credit to the inventor, by confirming the efficacy, the infallibility, and the originality of the invention.

The principle on which all Locks depend, is that of applying a lever to an interior bolt by means of a communication from without, which moves it in such direction as the lid, drawer, or door to be secured may require. The security of Locks

therefore, and their comparative excellence, are determinable by the number, variety, and disposition of the wards, or other impediments inserted in the passage by which the lever, or key is conveyed to the bolt. If these outworks do not secure the bolt from the intrusion, and application of *every instrument* but its proper key, the Lock is inadequate to its intended purpose; and however intricate or difficult, the passage to the bolt may be rendered by a skilful and judicious disposition of the wards; yet, if *any* access to the bolt is practicable by a workman of equal skill with its maker, the Lock is defective in the main point of excellence, which is *effectual security*; and is entitled to no higher claim than comparative merit.

The Construction of Locks, is a subject on which many ingenious mechanics have employed their thoughts; and the art hath received many, and great improvements from their labours. Locks have been constructed, and are at present much used, and held in great esteem; from which the picklock is effectually excluded; but the admission of false keys is an imperfection for which no locksmith has ever found a corrective; nor can this imperfection be remedied whilst the protection of the bolt is wholly confided to FIXED WARDS. For, if a Lock of any given size be furnished with wards in as curious and complete a manner as it can be; those wards being necessarily expressed on what is termed by locksmiths the bit or web of the key, do not admit of a greater number of variations than can be expressed on that bit or web; when therefore as many Locks have been completed of the given size as will include all the variations which the surface of the

bit will contain, every future Lock must be the counterpart of some former one, and the same key which opens the one will of course unlock the other. It hence follows, that every Lock which shall be fabricated on this given scale, beyond the number at which the capability of variation ends, must be as subject to the key of some other Lock, as to its own; and both become less secure as their counterparts become more numerous. This objection is confirmed by a reference to the Locks commonly fixed on drawers and bureaus, in which the variations are few, and these so frequently repeated from the infinite demand for such Locks; that, *if* they were formed to resist the picklock, they would be liable to be opened by ten thousand correspondent keys. And the same observation applies in a greater or less degree to every lock in which the variations are not endless.

But if the variations of Locks in which the bolt is guarded only by fixed wards could be multiplied to infinity, they would afford no security against the efforts of an ingenious locksmith. For though an artful and judicious arrangement of the wards, or other impediments, may render the passage to the bolt so intricate and perplexed, as to exclude every instrument but its proper key; a skilful workman having access to the entrance, will be at no loss to fabricate a key which shall tally as perfectly with the wards, as if the Lock had been open to his inspection. And this operation may not only be performed to the highest degree of certainty and exactness, but is conducted likewise with the utmost ease. For the block or bit, which is intended to receive the impression of

the wards, being fitted to the key-hole, and the flank of the key bored to a sufficient depth to receive the pipe, nothing remains but to colour the bit with a preparation, which, by a gentle pressure against the introductory ward, may receive its impression, and thus furnish a certain direction for the application of the file. The block or bit being thus prepared with a tally to the first ward, gains admission to the second, and a repetition of the means by which the first impression was obtained, enables the workman to proceed, till by the dexterous use of his file he hath effected a free passage to the bolt. And in this operation he is directed by an infallible guide: for, the pipe being a fixed centre on which the key revolves without any variation, and the wards being fixed likewise, their position must be accurately described on the surface of the bit which is prepared to receive their impression. The key therefore may be formed, and perfectly fitted to the Lock, without any extraordinary degree of genius, or mechanical skill. It is from hence evident that endless variations in the disposition of FIXED WARDS, are not alone sufficient to the purpose of *perfect* security.

I do not mean to subtract from the merit of such inventions, nor to dispute their utility and importance. Every approach towards perfection in the art of Lock-making may be productive of much good; and is at least deserving of commendation and encouragement; for if no higher benefit were to result from it, but the rendering *that* difficult or impossible to *many*, which is still practicable, and easy to a

few, it furnishes a material security against those from whom the greatest mischiefs and dangers are to be apprehended.

The first claimant to merit in this branch of mechanics is Mr. BARON, whose Lock is undoubtedly, and beyond all comparison, more excellent and more secure, than any Lock that ever was in use before his invention was made known. An observation or two upon Mr. Baron's Lock will however illustrate what I have said on the subject of fixed wards, and prepare my readers to comprehend more readily, the principle on which my own Lock is constructed.

It appears from the object of improvement which employed Mr. Baron's attention in the construction of his Lock, that he was aware, and as sensible as I am of the impossibility of guarding the avenues to the bolt so effectually by FIXED WARDS, as to prevent all access to it; for leaving the entrance and passage, to the common protection of wards and outworks, his ingenuity hath been wholly applied to the interior fortification of the bolt, by a new and judicious application of additional tumblers. These are a kind of grapple by which the bolt is confined as well in its active as its passive station, and rendered immoveable, till set at liberty by the key. One of these instruments is commonly introduced into all Locks that are of any use or value; it is lodged behind the bolt, and is governed by a spring which acts upon the tumbler, as the tumbler acts upon the bolt. The application therefore of any force to the tumbler, which is superior to the force of the spring, will cause it to quit its hold, and set the bolt at liberty. And in this operation no skill or nicety is

required, to ascertain the degree of force to be applied; for, it matters not how far the tumbler is lifted above the point, at which it ceases to controul the bolt. But in Mr. Baron's Lock the case is otherwise. He hath not only improved upon the practised method of applying the tumbler, but hath given it an office which is perfectly new, and of more importance to its security, than any impediment which art can oppose to the introduction of a false key. Instead of leaving his tumblers liable to be forced to an indefinite distance from the point at which they cease to controul the bolt; he hath confined their action within a circumscribed space, cut in the center of the bolt, of a dimension barely sufficient to the purpose they are intended to answer. This space or groove, is, in form, an oblong square, and is not only furnished with niches on the under side, into which the hooks of the tumblers are forced by the spring as in other Locks, but is provided likewise with correspondent niches on the upper side, into which the hooks are driven, if any greater force be applied to the tumblers, than is required to disengage them from the bolt.—Hence it becomes absolutely necessary in the fabrication of a false key, that the pressure of the extreme point of its bit on the tumblers, be proportioned with the greatest degree of exactness to the point of height to which they must be raised, to release the bolt; for otherwise the power which disengages the hooks on the one side will fix them on the other, and still leave the bolt immovable. This improvement, which does great credit to Mr. Baron's mechanical skill and invention, being as useful and important in effect, as it is new and curious in principle, must be admitted by every competent

and impartial judge, to be a very valuable acquisition to the art of Lock-making.—But greatly as the art is indebted to the ingenuity of Mr. Baron, he hath not yet attained that point of excellence in the construction of his Lock, which is essential to perfect security.—His improvement hath greatly increased the difficulty, but not precluded the possibility of opening his Lock, by a key made and obtained as above described; for an impression of the tumblers may be taken by the same method, and the key be thence made to *act* upon *them* as accurately, as it may be made to *tally* with the *wards*. Nor will the practicability of obtaining such a key be prevented, however complicated the principle, or construction of the Lock may be, whilst the disposition of its parts may be ascertained, and their impression correctly taken from without. I apprehend the use of additional tumblers to have been applied by Mr. Baron, as a remedy for this imperfection, because a less object would not have been worthy the exercise of his great talents and ability; and, because (if such were his intentions) he did not overrate the effect, which the cause was capable of producing. He seems evidently to have conceived the principle, but hath certainly failed in the execution. For, by giving an uniform motion to the tumblers, and presenting them with a face which tallies exactly with the key, they still partake in a very great degree of the nature of FIXED WARDS, and the security of his Lock is thereby rendered in a proportionable degree defective. To make these remarks more intelligible, I must intreat my readers to suppose the key, with which the workman is making his way to the bolt, (by the process above described) to have passed the wards, and to be in contact with

the most prominent of the tumblers. The impression, which the lightest touch will leave on the key, will direct the application of the file, till sufficient space is prepared to give it a free passage. This being accomplished, the key will of course bear upon the tumbler, which is most remote; and being formed by this process to tally with the face, which the tumblers present, will acquire as perfect a command of the Lock, as if it had been originally made for the purpose. And the key, being thus brought to a bearing on all the tumblers at once, the benefit arising from the increase of their number, if multiplied to fifty, must inevitably be lost; for, having but one motion, they can act only with the effect of one instrument.—But nothing is more easy than to remove this objection, and to obtain perfect security from the application of Mr. Baron's principle.

If the tumblers, which project unequally, and form a *fixed* tally to the key, were made to present a plane surface, it would require a separate, and unequal motion to disengage them from the bolt; and consequently, no impression could be obtained from without, that would give any idea of their positions with respect to each other, or be of any use even to the most skilful, and experienced workman, in the formation of a false key.

The correction of this defect would rescue the *principle* of Mr. Baron's Lock, as far as I am capable of judging, from every imputation of error, or imperfection; and, as long as it could be kept unimpaired, would be a perfect security.—But the tumblers on which its security depends, being of a slight

substance, exposed to perpetual friction, as well from the application of the key, as from their own proper motion; and their office being such, as to render the most trifling loss of metal fatal to their operation, they would need a further exertion of Mr. Baron's ingenuity to make them durable.

Duration, and an exemption from many casual disorders, to which other Locks are liable, are qualities, which the projector of solid wards, appropriates in a peculiar degree to his invention.—That they are more durable, and less subject to disorder, than wards more delicately constructed, are claims which I believe no locksmith will dispute with him. But, if his *Locks* are less exposed to the effects of time and chance, he hath certainly furnished them with *keys*, which do not possess the same properties. They are less formed for duration, and are more liable to accidental injuries, than the keys of any Locks I have ever seen. For the various angles they describe, unavoidably subject them to perpetual entanglements; and the stem (which in other keys is protected by the web) being left bare, is rendered considerably weaker, as well as more liable to be deformed; and of course must give more frequent occasion to call in the assistance of the locksmith. The key having thus lost as much, as the Lock is said to have gained in point of duration, the degree of frailty is upon the whole, undiminished;—and, being less equally distributed, will of course be more inconvenient. The introduction of solid wards may therefore be more properly termed an alteration, than an improvement in the art of Lock-making.

The refiftance of picklocks, and the entire exclusion of falfe keys, is a property, which is likewise afcribed to the folid ward Lock. But to this excellence it hath no juft pretention. For it poffeffes, in common with all other Locks, the imperfection of being liable to be opened (in the manner above defcribed) by a lockfmith of any tolerable degree of fkill; and it hath this peculiar difadvantage, that the key may be more eafily copied, than thofe of the moft common Locks. It feems, therefore, that the fole property of this invention might have remained with the projector without a patent.

I could add many reafons to thofe I have given, in proof of my original pofition, “that all dependence on the *invulnerable* fecurity of Locks (even of thofe which are conftituted on the beft principle of any in general ufe) is fallacious.”—But, prefuming that I have proved by fair, and juft obfervations, that Mr. Baron’s Lock is fhort of perfection, it would be a trefpafs on my readers to adduce further arguments, to demonftrate that every other warded Lock is greatly deficient in the effential properties, and very unequal to the important purpofe, of an effectual fecurity.

To find out, and to difclofe *irremediable* errors, in any fystem of art or fcience, which engages the confidence, and is neceffary to the fecurity, or fatisfaction of mankind, is the office of an invidious and unbenevolent mind. If, therefore, the defects and imperfections, which I have imputed to, and pointed out in the principle, or the conftituted of all other Locks, are not effectually remedied in that which I prefume to offer to the public, as a complete, and, as far as the Lock is

concerned, an inviolable security; the communication of my observations will be more prejudicial than useful, and consequently be more deserving of censure than commendation. But, if it shall appear that I have not wantonly divulged their defects, without offering at the same time a certain and effectual remedy, I may fairly hope, that my invention will receive that approbation and encouragement, which is due to great improvements, in objects of universal use and importance.

From the various methods, which have been successively used to secure property, or to insure personal safety, it may be collected that the arts of violation have improved in at least an equal degree, with the contrivances which mechanical ingenuity hath invented and applied for security. And this evil hath arisen (in the case of Locks) from the misapplied efforts of ingenious mechanics, to effect *that* by a *complex* principle, which a simple one only can produce. In proof of one part of this proposition, I may refer to the most perfect Locks, that ever were constructed; to demonstrate the other, I shall give a specification of my own.

The idea of constructing a Lock, that might resist every application, and effort of art, was first suggested to me (as I have before observed) by the alarming increase of HOUSE ROBBERIES; which, there is great reason to believe, are as often perpetrated by perfidious servants—or accomplished by their connivance, as by any means that are used by the common house-breaker. In this view of the evil to be remedied, it was evident, that a Lock or fastening, which might effectually

exclude the one, would be no security against the other; and, that no Lock would completely answer its intended purpose, unless a free and deliberate access to the key-hole could be rendered as useless to the purpose of obtaining a key by impression; as, the picklock, and other instruments of mischief, may be rendered (to the purpose of opening the Lock,) by the multiplicity and intricacy of its wards. The hasty execution of a midnight robbery, in which the servants of the family do not act a part, will not allow sufficient time, (if proper instruments were at hand) to overcome the difficulties, which, ingenious locksmiths have opposed to *foreign invaders*; my chief attention, therefore, was applied to contrive a security against the advantage, which a *domestic* enemy possesses, in the opportunity of executing his purposes at his leisure. But, practicable as I conceived this to be, I did not venture to attempt it by any means, which had hitherto been found ineffectual. I had not the presumption to imagine, that I could give perfection to an instrument, which men of much greater knowledge and ability, had left defective. I was, therefore, as solicitous to avoid their *excellences*, as to escape their *imperfections*, which, are so blended in the best Locks, as to make it impossible to adopt the one, without falling into the other. And a very little thought on the subject, convinced me, that my success would depend on the application of a principle, as dissimilar as possible, to that, by which other projectors had in vain sought to attain perfection, in the art of Lock-making. And as nothing can be more opposite in principle to *FIXED WARDS*, than a Lock which derives its properties, from the *motion* of all its parts, I determined, that

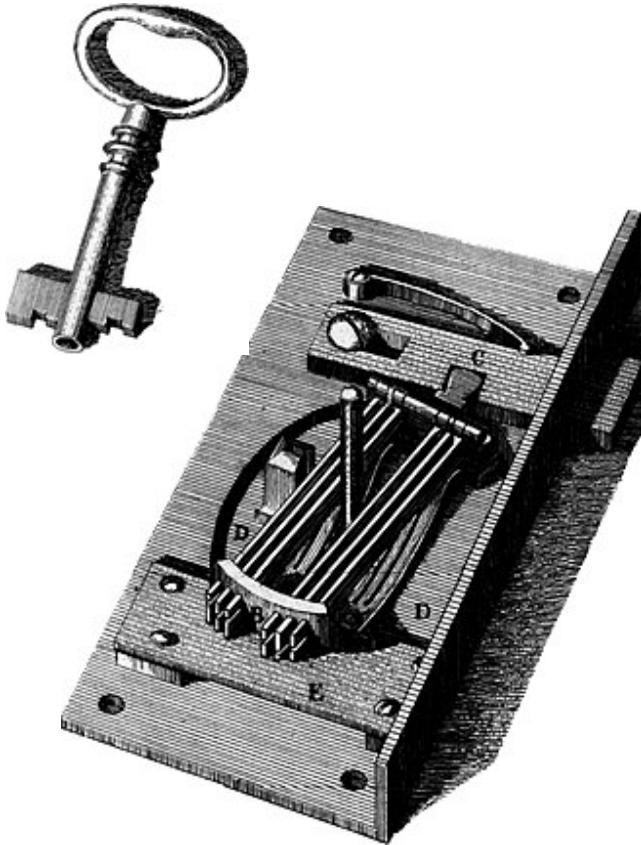
the construction of such a Lock, should be the subject of my experiment.—In the prosecution of my purpose, various models were constructed; and I had the satisfaction to receive from the *least* perfect of them, the clearest demonstration of the truth, and certainty of my principle. The exclusion of wards, made it necessary to cut off all communication between the key and the bolt; as, the same passage, which (in a Lock *simply* constructed,) would admit the key, might give admission likewise to other instruments. The office, therefore, which in other Locks is performed by the extreme point of the key, is here assigned to a lever, which cannot approach the bolt till every part of the Lock hath undergone a change of position. The necessity of this change to the purposes of the Lock, and the utter impossibility to effect it, otherwise than with the proper key, are the points to be ascertained, by a specification of the component parts of the movement, and an explanation of their respective offices.

Among the various methods of applying the principle of motion, in the construction of Locks, which have yet occurred in my practice, I think those, described in the subjoined plates, are to be preferred, for their simplicity.

The first plate shows the interior face of a Lock, which was constructed, at a very early period of my experiment, and was intended merely as a model, to try the efficacy

Plate 1st.

F



of the principle; but, to my great admiration, it turned out a complete instrument of security; and gave the clearest demonstration, that the principle was certain and infallible.

SPECIFICATION.

Plate the first.—The lines, which cross the face of the Lock, represent six levers, which are united in a joint, and turn on a common axis, at the point A. Each lever rests on a separate spring, of sufficient strength to sustain its weight, or, if depressed by a superior force, to restore it to its proper position, when that force is withdrawn. The curve B represents a frame, through which the levers are carried by separate grooves, or passages; these grooves are exactly fitted in their width, to the thickness of the levers, but are of sufficient length, to allow them a free motion, in a perpendicular direction, whether lifted by the elastic power of the springs, on which they rest; or sunk by the pressure of a superior weight from above. The part, which projects from the opposite side of the joint, or carriage, A, and inserts its extreme point in the bolt, at C, is a lever of a different form, which acts in subordination to those above described; to this lever, two offices are assigned, the one to keep the bolt in a fixed, and immoveable position, in the absence of the key;—the other to give it its proper motion, when the key is applied. The joint, or carriage of the levers, and the springs on which the levers bear, are fixed on a circular platform, D, which

turns on a center; and in its motion impels the bolt, in either direction, by means of the lever, which is projected from the joint A.—To give this machine the property of inviolable security, it was necessary to subject its motion to some restraint, which the key only could remove. This power is lodged in the part E, which is a thin plate, bearing at each extremity on a block, and having of course a vacant space beneath, equal in height, to the thickness of the blocks on which it rests. This plate is applied either to check, or to guide the motion of the machine; and these opposite offices are thus performed.—On the edge of the plate, which faces the movement, six notches are expressed, into which the points of the levers, projecting beyond the frame B, are received; and whilst they are so confined, the motion of the machine is totally suspended, and the bolt so fixed, as to defy every effort of art, or force, to move it.—The necessity of the proper key, to the purpose of opening this Lock; and the impossibility of effecting it by other means, will be clearly seen from the process, by which the machine is put in motion. It is to be observed, that each lever has a notch expressed on its extreme point; and, that those notches are disposed as irregularly as possible. To give a capacity of motion to the machine, these notches must be brought parallel to each other, and, by a distinct, and unequal pressure upon the levers, be formed into a groove, in a direct line with the edge of the plate E, which, the notches are exactly fitted to receive. The least motion of the machine, whilst the levers are in this position, will introduce the edge of the plate into the groove; which, controlling the power of the springs, will give liberty to the

levers to move in an horizontal direction, as far as the space between the blocks, which support the plate E, will admit, and which is sufficient to give the machine a power of acting on the bolt.—The impossibility of thus bringing the notches, expressed on the points of the levers, to fall into a direct line, and to form a groove, which shall perfectly tally with the edge of the plate E, by any other means, than the application and impulse of the key, is the principle of security, which constitutes the peculiar excellence of this Lock.

The key, which is represented by the figure F, exhibits six different surfaces on its bit, against which the levers are progressively admitted, in the operation of opening the Lock; the irregularity of these surfaces describes the distinct, and unequal degree of pressure, which each lever requires to bring them to their proper bearings, for the purpose of putting the machine in motion. It hence appears, that unless the various heights of the surfaces, expressed on the bit of the key, are exactly proportioned to the several distances, to which the levers must be carried, to bring their notches into a direct line with each other, they must remain immovable; and, as one stroke of a file, is sufficient to cause such disproportion, as will prove an insurmountable impediment to their motion; I may safely assert, that it is not in art to produce a key, or instrument, by which a Lock, constructed on this principle, can be opened.

It will be a task indeed of great difficulty, even to a skilful workman, to fit a key to this species of Lock, though its interior face were open to his inspection; for the levers being

raised, by the subjacent springs, to an equal height in the frame B, present a *plane* surface; and, consequently, convey no direction, that can be of any use in forming a tally to the *irregular* surface, which they present, when acting in subjection to the proper key. Unless, therefore, a method be contrived to bring the notches, expressed on the extreme points of the levers, in a direct line with each other, and *to retain them in that position, till an exact impression of the irregular surface, which the levers will then exhibit, can be taken*; the workman will, in vain, attempt to fit a key to the Lock; or, by any effort of art, to move the bolt. And when it is considered, that this process will be greatly impeded, and may perhaps be entirely frustrated, by the action of the springs; it must appear that great patience and perseverance, as well as great ingenuity, will be required; to give any chance of succeeding in the attempt. I do not state this circumstance, as a point essential, or of any importance to the purpose of the Lock, but to prove more clearly, what I have before observed upon its principle, and properties: for, if such difficulties occur to a skilful workman, as to render it almost, if not altogether, impracticable, to form a key, when the Lock is open to his inspection, and its parts accessible to his hand; it pretty clearly demonstrates, the *impossibility* of accomplishing it, when, no part of the movement, can be touched or seen.

It will naturally be imagined by the reader, that the same difficulties, which occur in the formation of a key, in the second instance, must have been experienced by the maker of the Lock; and that, however insuperable they may be to other

workmen, they were easily conquered by him. But the contrary is the case. No such difficulties occur in forming the original key; nor is any greater ingenuity exercised in the formation of it, than falls to the share of a common workman; for the key is not fitted to the Lock, but the Lock adapted to the key: and this is effected by a mean the most simple, and the most easy, that can be imagined. The surfaces, expressed on the bit of the key, are worked, as chance, or fancy, may direct; without any reference to the Lock. The key being so completed, and applied to the surface of the levers; a gentle pressure will force them to unequal distances from their common station in the frame B; and, sink their extreme points to unequal depths, into the space beneath the plate E. Whilst the levers are in this position, the edge of the plate E, will mark the precise point at which the notch, on each lever, must be expressed.

Plate 2.

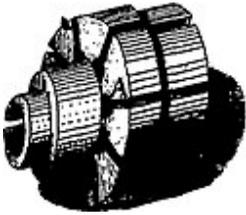


Fig. 1



Fig. 2



Fig. 3

Fig.



4



Fig. 5

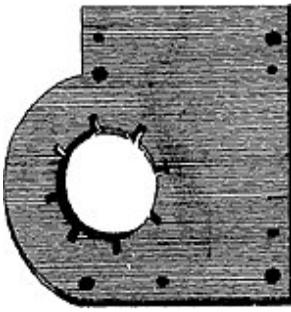


Fig. 6

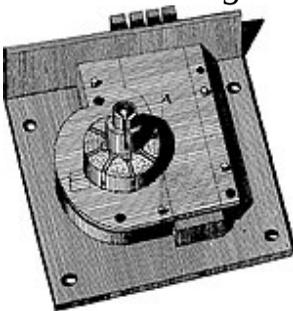
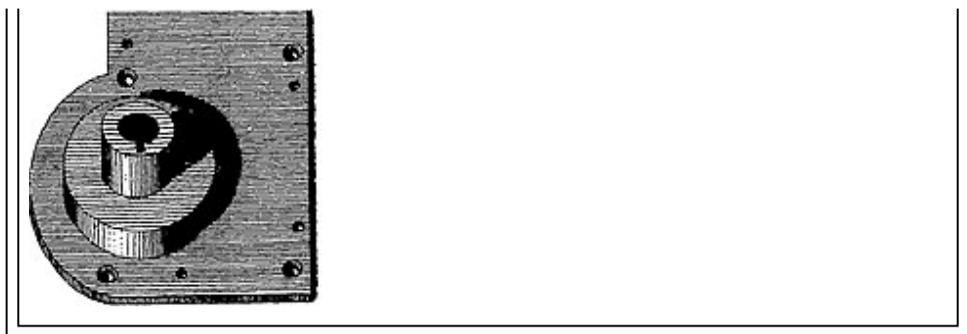


Fig. 7

Fig. 8



The notches being cut by this direction, the irregularity, which must appear in their disposition, when the levers resume their station in the frame B; and, the inequality of the recesses, expressed on the bit of the key; will be as a seal, and its impression to each other.

Having endeavoured (and I hope with effect) to give a just conception of the PRINCIPLE, and to prove, that inviolable, security *infallibly* results from the most *simple* application of it; I shall proceed to give an example of its effect, in a Lock more curiously constructed, and, in which it is more extensively applied.

The first figure of the second plate, represents a circular block of metal, divided from its center into eight compartments; each compartment containing a cell, which forms a passage through the block, as represented by the small circles, described on the flat surface A.—In each of these cells, two grooves are cut at opposite points, which open a communication with the center at one point; and with the spherical surface of the block, or barrel, at the other.—The small circle, which marks the center of the flat surface A, is the key-hole, which likewise forms a passage through the barrel, in a parallel line with the cells, which surround it.—This figure represents the frame, in which, the parts that compose the active principle of the Lock, are deposited.—To render the operation of these parts, and their respective offices perfectly intelligible, they are both individually, and collectively, represented on the plate.

The second figure describes a spiral spring, which is lodged in the bottom of each cell, and occupies one half of its space. The other half is filled with a slider, which rests on the spring, and is represented by *the third figure*. The office of these sliders, exactly corresponds with that of the levers, in the model above described: for, when lodged in their respective cells, they are upheld, like the levers, by the elastic power of the springs on which they rest; till a pressure superior to that power is applied;—and are again restored to their stations by the reaction of the springs, when the weight, which depressed them, is withdrawn. Each slider projects its side B (as appears in *the fifth figure*) beyond the spherical surface of the barrel, or frame, which contains it; as the extreme points of the levers (in the above model,) are projected beyond the curved frame, in which they move. The point C is projected through the interior groove, into the space which forms the center, or key-hole, expressed on the flat surface A.—When the key, therefore (which *the fourth figure* represents,) is applied, it must of course encounter these interior projections; and when pressed forward, (the spaces indented on its point being unequal,) will force the sliders to unequal distances from their bearings; and bring the notches, expressed on their exterior projections, in a direct line with each other; in the same manner, and for the same purposes, that a similar effect is produced, by the pressure of the key upon the levers, in the model above described, for it is to be observed, that the disposition of the notches in this, as in the former instance, is marked, while the sliders are under the pressure of the key. When the key, therefore, is withdrawn, and the sliders resume

their station in the cells, through the action of the springs, the disposition of the notches must be *irregular*, in the same proportion and degree, that the indentures on the point of the key are *unequal*: and they will necessarily fall again into a direct line with each other, whenever the sliders are depressed by the key.

The fifth figure represents the barrel, or frame, completely furnished and fitted for action. The interior end of the barrel, is capped with a plate, which, unites its compartments, and confines the springs and sliders, within their respective cells. From that plate the point A proceeds; which represents the lever by which the bolt is projected, or withdrawn, according to the direction in which the machine performs its revolution.

The sixth figure, represents the flat surface of a thin plate; which corresponds *in its office* with the part C, described in the specification of the model. The space, cut in its center, is exactly fitted to the spherical surface of the barrel;—the circle, describing its circumference;—and the notches cut on its edge, coinciding with the projections of the sliders. The barrel, being encircled by this plate, at the middle of its spherical surface, its motion is entirely suspended; till the notches, expressed on the projections of the sliders, are forced by the pressure of the key, into a line with each other:—a groove being thus formed on the spherical surface of the barrel,—parallel to, and coinciding with, the edge of the plate; the machine is at liberty to perform a revolution, in either direction, as its office may require; but returns to its confinement, when the key is withdrawn.

The component parts of the movement, being thus united, the interior end of the barrel is deposited in a bed, which *the seventh figure* represents; and to which it is fastened at the angles of the plate (*figure 6*) by which the barrel is encircled. The station of the bolt is at A.—The lever, which acts upon it in the revolution of the barrel, is projected on the opposite side.

The eighth figure is a cap, or mask, which incloses the face of the movement, and completes the Lock.

The peculiar security of Locks, constructed on this principle, consists in two points of excellence, which no other Lock possesses; namely,—*The infinitude of their variations*,—by which the production of *correspondent* keys is avoided, however great the number of Locks may be, that are manufactured on any given scale.^[1] And, *The property of motion*,—which, precludes all possible means of obtaining an impression of their interior parts, for the purpose, of fabricating *false* keys. The former is capable of demonstration: the latter is self-evident.—The variations, by which the production of correspondent keys is avoided, have two sources; the one, arising from the changes, that may be made in the disposition of the levers;—the other, from the number of points, contained on the projected surface of each lever, by which the position of its notch may, in the smallest degree, be varied.

The variations, producible in the disposition of six figures only, are 720; these, being progressively multiplied by

additional figures; will increase, by astonishing degrees; and eventually show, that a Lock, containing twelve levers, will admit of 479,001,500 changes; which, the addition of another lever will increase to 6,227,019,500.—These, being again multiplied by the number of changes, which, the projected surface of the levers will admit, in the disposition of the notches; their amount will exceed numeration; and, may, therefore, be properly said to be infinite.—The slightest inspection of these Locks, will, at once, evince, that I do not over-rate the effect of their property of motion; in asserting, that it precludes all possible means, of obtaining an impression of their interior parts; which, is necessary to the fabrication of a false key: for, it will be clearly seen, that the positions, into which the levers are necessarily forced, by the pressure of the key, in the operation of opening the Lock; can no more be ascertained, when the key is withdrawn; than a seal be copied from its impression on a fluid;—or the course of a ship be discovered, by tracing it on the surface of the waves. But inviolable security is not the only excellence they possess; the simplicity of their principle gives them likewise a great advantage over Locks, that are more complicated, in point of duration: for their essential parts being subject to no friction; nor exposed to any possible accident from without; they will be less affected by use, and less liable to stand in need of repair.

The imperfections and defects, which are common, in some degree, to *all* other Locks, being thus remedied; and, the principle here adopted, being an infallible security, against the

best directed efforts of the picklock, or any similar instrument of violation; I may, without presumption, lay claim to the credit of having brought the art of Lock-making to that perfection, which hath been long sought, but which, hitherto, hath been sought in vain. And being determined, that nothing on my part shall be wanting, to render the improvement universally beneficial; I have no difficulty in pledging myself, to those who may be induced to honour me with their commands; that I will no further avail myself of my patent, than to secure the property of the invention; and that every kind of Lock, constructed on the above specification; shall be delivered at a price, as low as the expence of manufacturing, with the addition of a very small profit, will admit.

THE END.

1. ↑ The value of this property is inestimable in the case of street-door Locks: for no method of robbery is more practised, than gaining admittance into houses by these keys; which, (as is well known,) may be procured at the old iron shops, to fit almost any Lock in use. Such robberies are generally committed, where the servants are allowed to take the key with them, when sent on errands; it being impracticable, whilst the key is fixed in the Lock.

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