

NOTE E.

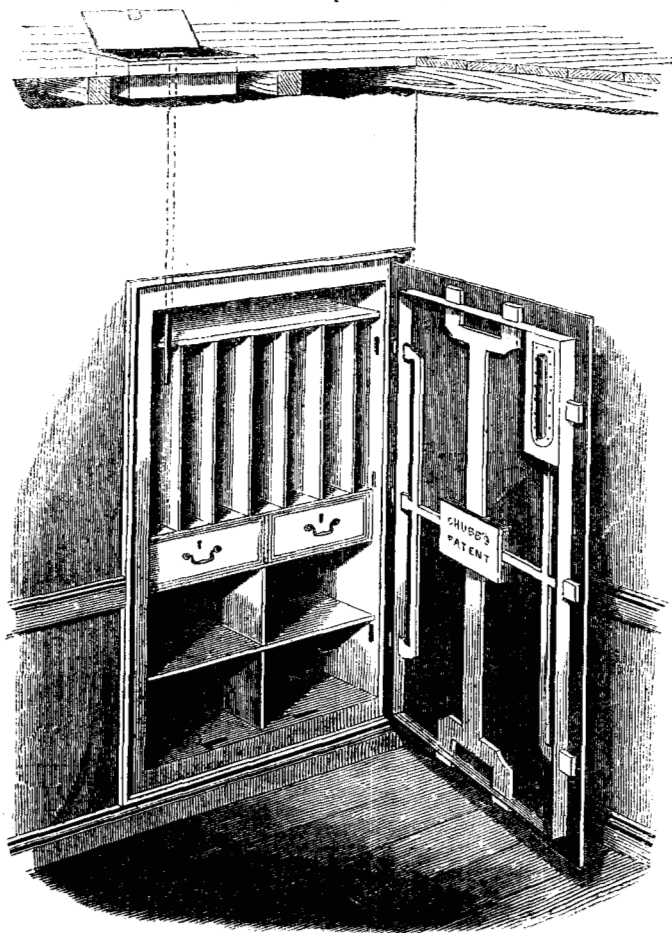
LIST OF REFERENCES to the "TRANSACTIONS of the SOCIETY of ARTS," on the subject of LOCKS.

Vol. 1. . . .	Page 317 . . .	Mr. Moore.
" 2. . . .	" 187 . . .	" Cornthwaite.
" 3. . . .	" 160 . . .	Marquis of Worcester.
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" 18. . . .	" 239 . . .	T. Arkwright.
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" 36. . . .	" 111 . . .	M. Somerford.
" 38. . . .	" " . . .	A. Ainger.
" " . . .	" 205 . . .	Bramah.
" 42. . . .	" 125 . . .	J. Duce.
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" 45. . . .	" 123 . . .	Machin.
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Mr. CHUBB said, that in writing the paper, the greatest difficulty was to condense the voluminous mass of information within the necessary limits. He had, however, prepared an Appendix, containing some suggestions as to the best means of securing the strong rooms of banks, and other places, and also a chronological list of patents for improvements in locks, since the establishment of the first patent law, in the reign of James I., together with a list of those persons who had received prizes from the Society of Arts, for various improvements in secure fastenings.

It was a well-known fact, that an unsuccessful attempt to rob a bank was scarcely ever heard of, the anticipated booty being so considerable, that the burglars could afford to spend considerable time in devising complete and effective plans. Indeed they frequently spent months in examining the locality, and in obtaining information, when, if no chance of success appeared, the enterprise was quietly abandoned. In many country banks, great carelessness was shown, both in regard to the quality of the locks, and in the custody of the keys. A good plan, sometimes adopted, was to have a bolt extending from a room on the second, or third story, which after traversing the back of the iron door of the strong room, was let into a socket in the top, and sometimes down into the bottom cill of the door; in some cases, the room fixed upon was the bedroom of the manager, so that the bolt could only be raised, or lowered, with his knowledge.—(Fig. 8.)

Fig. 8.
Chubb's Fire-proof Iron Safe,



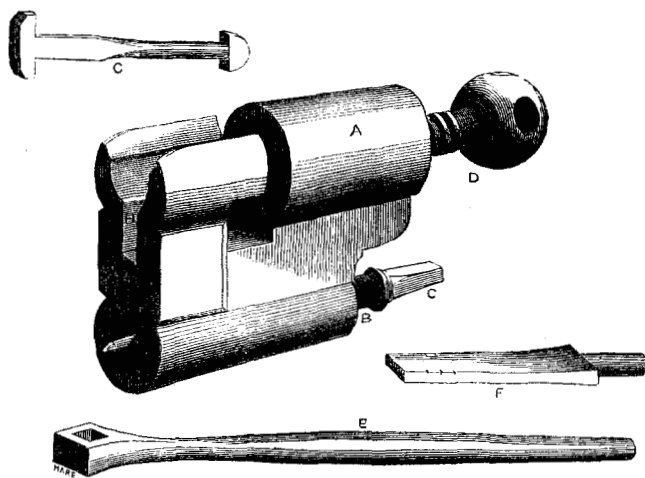
Another plan was to have a dry well beneath the floor of the basement, into which the safe was lowered every night, the greatest care being taken to guard against damp. No one lock should be depended on, but security should be obtained by having three, or four locks of different combinations.

It must also be borne in mind, that fire-proof safes and chests were required to preserve books, documents, and money, as much from fire as from thieves. Many safes which were sold as fire-resisting, were made of the thinnest plate iron, so that they would
[1849-50.]

of course be crushed, and the contents destroyed, in case of timbers, or brickwork, falling upon them. They should consist of a double casing of strong wrought iron, the intermediate space being filled with a good non-conducting substance; bolts should shoot out from all sides of the door, so that if the whole building fell, the iron safe would not be injured either by the heat, or by the fall of the materials. The best practical proof of the efficiency of strong, well-constructed fire-proof safes, was, that of some thousands made on this principle by Mr. Chubb, there was not a single instance of a failure having occurred from any cause.

Some years ago, one of Chubb's locks, fixed on a common iron safe, was forced open by a burglar's instrument, called a "Jack-in-the-Box." That instrument was of such ingenious construction as to demand a particular description.—(Fig. 9.)

Fig. 9.
Jack-in-the-Box.



A was the stock, made of solid brass; B was a strong screw with a point, which was worked at the end C by means of a spanner, or lever key, E. D was a powerful screw, working in the upper part of the stock A, and turned backwards, or forwards, by the handle of the lever E. The point of the screw D was made hollow, to receive a straight steel bar F. G was a steel clamp, with square shoulders at each end.

The manner in which this instrument was used to open doors and safes might be thus described. One end of the clamp G was inserted sideways into the keyhole, and turned a quarter round, whilst the other end was slipped into the groove H in the stock.

The point of the screw **B** was then screwed up close to the front of the safe, and the instrument was fixed. The large screw **D** was then withdrawn to fit the bar **F** into the socket at its end, and by applying the lever **E** to the head of the screw **D**, the bar **F** was forced steadily onwards, until either the lock was broken, or the door was burst open.

As this instrument had the power of lifting three tons weight, it was evident that some part of the door must give way under its pressure; and, in doors made on the common principle, the lock and a portion of the lock-case must be torn away, then by throwing back the bolts, the contents of the safe were in the power of the burglars.

Since the occurrence of the before-mentioned accident, Mr. Chubb had adopted the plan, in his recent safe locks, of cutting a square piece out at the back of the keyhole, and refixing it only by small screws, so that on the application of the "Jack-in-the-Box," that piece only was removed. He produced a lock constructed in this manner which had been so operated upon; the plate had been forced away, leaving the lock and bolts, and thus the burglars were baffled in their attempt.

Mr. FAREY observed, that the mechanism of locks had been a favourite subject with him, from an early period of his studies, when he had the good fortune to be intimate with Mr. Joseph Bramah, and had acquired a knowledge of his locks, which were then in high repute. The secret workshops, wherein the locks were manufactured, contained several curious machines, for forming parts of the locks, with a systematic perfection of workmanship, which was at that time unknown in similar mechanical arts. These machines had been constructed by the late Mr. Maudslay, with his own hands, whilst he was Mr. Bramah's chief workman.

The important part of Bramah's lock was the central hollow part, called its revolving barrel, with steel locking sliders, to receive the end of the key. On looking into this barrel, the narrow ends of the six steel sliders could be plainly seen, all radiating from the centre pin; at the end of the key, there were six corresponding radiating notches, but the length of each notch was different.

In using the lock, the key was first pushed endways into the barrel, as far as it would go, when it was felt to be entering in opposition to a spring. The key acted against all the six sliders at once, but it pushed back each slider to a different distance, according to the lengths of the several notches in the key, which were just suitable for placing each one in, what might be called, its unlocking position; and all the six sliders being so placed at the same time,

they would leave the barrel at liberty to be turned round by the key ; the bolt of the lock was shot by a curious crank-pin motion, in a slot, but the key itself had no communication with the bolt, as in all other locks.

The steel sliders, which should be at least six in number, were lodged in as many detached grooves, cut out lengthways in the metal of the barrel, so as to allow each slider to have an independent endway motion in its own groove. The barrel was held in its place in the lock sideways and endways, by being truly fitted into a circular hole in a fixed steel plate, in which hole the barrel could be turned round by the key, after it had been inserted, and had moved all the sliders, to their unlocking positions. On removing the key from the lock, all the sliders were pushed endway forwards, by their spring, interlocking into corresponding radial notches in the steel plate, so as to fasten the barrel and prevent it from turning round.

The unlocking position of each slider was, when that slider was moved so far in its groove, that an unlocking notch in the outer edge of the slider, came precisely opposite to the edge of the fixed steel plate, which would then allow the barrel to turn round, provided that every one of the sliders was so moved to its unlocking position at the same time ; but any slider which was not moved far enough in its groove, would not arrive at its unlocking position ; or any slider, being moved in its groove beyond its unlocking position, would interlock anew with the steel plate, and hold the barrel fast.

The machines, before mentioned, were adapted for cutting the grooves in the barrels, and the notches in the steel plates, with the utmost precision. The notches in the keys, and in the steel sliders, were cut by other machines, which had micrometer screws, so as to ensure that the notches in each key should tally with the unlocking notches of the sliders in the same lock. The setting of these micrometer screws was regulated by a system, which ensured a constant permutation in the notches of succeeding keys, in order that no two should be made alike. Mr. Bramah attributed the success of his locks to the use of those machines, the invention of which had cost him more study than that of the locks ; without the machines, the locks could not have been made in any great number, with the requisite precision, as an article of trade. There was great originality in those machines, which were constructed before analogous cases (beyond the clock-makers, wheel-cutting machines) were in existence.

The security of Bramah's lock against being picked, depended upon the circumstance that its several sliders must, each one for itself, be pushed in so far and no farther ; but how far, the lock

afforded no indication. It was nevertheless very objectionable, that the sliders should be so completely exposed to view. It had been suggested, that an universal false key for Bramah's locks might be made, with the bottoms of its several notches formed by as many small steel sliders, extending beyond the handle of the key, so as to receive pressure from the fingers, for moving each one of the sliders within the lock, with a sliding motion in its own groove, independently of the others; and during such sliding motion, a gentle force could be exerted, tending to turn the barrel round. Under such circumstances, supposing that the motion of the barrel was prevented by any one slider only, that one having to resist all the turning force, would be felt to slide more stiffly endways in its groove, and therefore it could be felt when its unlocking notch arrived opposite the steel plate, and left some other slider to begin to resist the turning force; such a circumstance presumed a palpable inaccuracy in the radiating correspondence between the notches in the steel plate, and the grooves for the sliders in the barrel, which could not happen with Bramah's workmanship.

It might be concluded, that a good Bramah's lock was not easily picked, by finding out its combination; but unfortunately if a Bramah's key fell into dishonest hands, even for a very short time, an impression could be easily taken, and a false key as easily made. A turkey quill notched into the form of a key, had sufficed to open a Bramah's lock; and an efficient false key could be formed out of a pocket pencil-case. Such facility of fabrication was an invitation to dishonesty, and as an abortive attempt left no trace, the impunity was an encouragement to repeat the attempt until success was attained.

A similarity of principle might be observed in Bramah's sliders, and the pins of the ancient Egyptian lock, the motions of the sliders, in the former case, and of the pins, in the latter, being in both independent, whereby any one out of the whole number would of itself secure the lock, which could not be opened until all the sliders, or pins, were brought to their unlocking position. Bramah's sliders required, however, great precision in the extent of this motion, and had also the advantage, that any one which was moved beyond its exact locking position, would interlock anew as effectually as if it had not been moved far enough.

In Barron's lock, a vast improvement was made by rendering the tumblers double-acting, and by combining two such tumblers. A common tumbler would only catch and detain the bolt, when the tumbler was let down, but it ceased to afford any security, if it was lifted beyond its contact with the bolt; hence an ordinary tumbler lock, with only one common tumbler, might have that tumbler

lifted, and kept up, by a picklock, so as to leave the bolt quite at liberty, to be moved by another picklock.

The double acting tumbler would only release the bolt, by being lifted to the exact height required for releasing it, and no higher; for if the tumbler was lifted any higher, it caught the bolt anew, and (by what was called "overlift") detained it as securely, as if the tumbler had not been lifted high enough. In attempting to lift this tumbler with a picklock, there was nothing to indicate when the tumbler was lifted to its exact height, and with two such tumblers requiring to be lifted independently, each one to its own proper height, but no higher, it was difficult to conceive how picklocks could be available.

Chubb's lock was a very improved modification of Barron's, containing six double-acting tumblers combined together, and also possessing the important adjunct of the "detector." In no instance had one of Chubb's locks been opened by picklocks, and, indeed, with a combination of six tumblers, it became exceedingly difficult to make a false key sufficiently accurate, to open a lock, because each step of the key required to be just sufficient to lift the tumbler, to which that step belonged; if the step was too long, the tumbler would be overlifted, and would thereby detain the bolt, or if the step was too short, it would not lift the tumbler high enough to release the bolt; no indication could be obtained by the trial of a false key in the lock, as to which of the steps was too long, or too short. The lock would be secured against unlocking, by any one, or more of the six tumblers, being either overlifted, or not lifted high enough; but it could not be ascertained which tumbler detained the bolt, or which step of the false key was incorrect. In such a state of uncertainty, all attempts to rectify the inaccuracy of the false key, must be directed by mere guess, and alterations were as likely to be made in the steps which were nearly correct, as in those which were wrong.

It was formerly thought, that a skilful workman, furnished with impressions taken from the true key, in wax, or soap, could make a false key to open any lock; and in common locks with the most elaborate wards, but with only one common tumbler, also in Bramah's locks, there was much truth in the notion; but for a lock with six double-acting tumblers combined, a false key made ever so carefully, according to impressions, would not be likely to open the lock, for want of exactitude in the lengths of the several steps; and if the key could not be made exact from the impressions, there would be no chance of rectifying it by trial, in the lock, on account of the total uncertainty as to which part required alteration.

Chubb's detector being combined with the six double-acting

tumblers, added very greatly to the security of the lock; for in the course of making trials with a picklock, or false key, if any one of the tumblers was lifted too high, it overset the detector detent, which by a spring action fastened the bolt, so as to secure it from being afterwards withdrawn; and although the bolt should be released from all obstruction by the other tumblers, the fastened tumbler would of itself continue to hold the bolt, as an additional detention, not capable of being removed, even by an ordinary application of the true key, which would not go round in the lock, after the detector was brought into action; and thus notice was given, that a fraudulent attempt had been made to violate the lock. To set the detector free, the true key required to be first turned partially round, in a reverse direction, whereby the detector was restored to its quiescent position, and then the true key would operate in the usual manner. It was only by overlifting any one, or more of the tumblers, that the detector could be brought into action, and the use of the true key could never overlift any tumbler, or disturb the detector.

In making a false key, the bit was usually left rather too long, being gradually reduced by trial until the proper length was attained. Though this process might succeed with a common lock, it had no chance with Chubb's lock, which would become detected by one trial with a false key, having even but one step too long, and if a step was too short at first, it was not easy to lengthen it. Hence the maker of a false key was beset with difficulty at every stage of his operations; and without tolerably accurate information respecting the true key, it was scarcely possible to find out the combination of the six tumblers, or to avoid bringing the 'detector' into action.

Mr. CHUBB said, in reply to Captain Moorsom, that if a lock had only one key, and it should happen to be lost, when the lock was fastened, the door would require to be forced open, but good locks generally had two keys, one of which was deposited in a place of safety. Two hundred and twenty locks might be made with one keyhole, and a separate key to each, yet having one master key for the whole; but if a greater number was required, it would be necessary to have two keyholes. In the event of the master-key being stolen, he knew of no remedy, but replacing the locks, or altering their combinations.

It was impossible to take a sufficiently correct impression, in wax, for the purpose of making a false key, as the locks were manufactured with such delicacy and nicety, that the slightest alteration, or difference in the key, would prevent the lock being opened by it.

Mr. VARLEY thought, that Somerford's lock was equal to Mr. Chubb's, and had double the power, as a key was weakened by the introduction of many wards. Somerford's lock had a series of tumblers, one-half of which had to be pulled by the key out of the notches, and the other half to be pushed out with false notches on the other sides, to re-lock by any excess of motion. That lock had been favourably noticed many years back by the Society of Arts, and was one of the most perfect of the tumbler kind. Mr. Bramah's first locks had been picked, and the late Mr. Clements had picked a beautiful lock made by Jacob Perkins. The false notches, subsequently introduced by Mr. Bramah, added wonderfully to the security of his lock.

With respect to the number of combinations of which locks were capable, it did appear to him that a certain limit should be assigned to it, in order to prevent any necessity for such close fitting, that rust, or dust on the key would prevent its opening the lock. A lock was exhibited some time back, the key of which had at first easily opened the lock; but when it was warmed the slight expansion caused by the heat prevented the key from acting on the bolts.

Mr. HODGE said, that in America he had repeatedly seen impressions taken of locks having twelve, or fourteen tumblers; certainly they were not made by Mr. Chubb, but were such perfect imitations of his locks, having even the detector, that there did appear to be a possibility of picking these locks; in fact, he would undertake to bring a man from New York who would be capable of doing it.

Mr. Mackinnon, after having succeeded in picking a tumbler lock, introduced an additional protection, which he termed a "curtain," made of a plate of case-hardened iron, three-quarters of an inch thick, radiating from the common centre of the lock, which prevented anything from reaching the tumbler, without first cutting through the curtain, which was next to impossible. The same gentleman had also made an expanding key, which was found to be very useful.

Mr. Hodge had recently purchased at a sale, an old bookcase, which had been made in Geneva, about the year 1762, having a lock with a protecting curtain, though without the expanding key; this curtain revolved when the key was inserted.

Mr. STEPHENSON, M.P., *V.P.*, imagined, that though it might be possible to take a wax impression of a warded lock, such could not be taken from a tumbler lock, for there was nothing in a lock of the latter description which could give, by any injection of wax, a knowledge of the length of travel of the different tumblers. He there-

fore considered Mr. Hodge had raised a problem which did not admit of solution, and he would venture to say, that it was not possible to pick one of Chubb's locks by the aid of any wax impression.

Mr. CHUBB produced specimens of Davis', Parsons', Williams', and Nettlefold's locks, and gave a brief description of each.

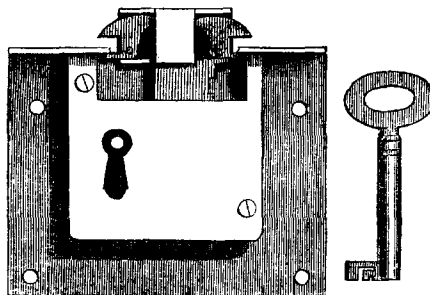
Davis' lock was made with a double chamber, and had wards on the sides of the keyhole. The key was inserted into the first chamber, and turned a quarter round; it was then pushed forward into the inner chamber, where there was a rotating plate, containing a series of small pins, or studs, which were laid hold of by the key. By turning the key, the plate was moved round, the tumbler was raised, and the bolt shot backwards, or forwards. This lock was now used to some extent on the Cabinet despatch-boxes; but it was expensive, without affording any very great security.

In Parsons' lock, the tumblers were of a particular form, being hinged on a pivot in their centres, and worked into, and out of, two notches cut in the under side of the bolt.

Williams' lock consisted of a number of pins, similar to those in the Egyptian lock, and operated upon by a spring, in the same manner as Bramah's lock. On the pins being pushed down by the key to their respective positions, the bolt was set at liberty, and was pushed backwards and forwards by two springs, one of which was strong enough to overcome the resistance of the other, during the action of locking, and was forced back by the key, to allow the weaker spring to act in unlocking. It had, like Bramah's, Barron's, and Chubb's locks, the advantage of the over-lift; but it was liable to be easily deranged, and was much too delicate for general use. In 1845, a joint-stock company was projected, with a capital of £30,000, for the purpose of working Williams' patent; but although the lowest amount of profit was estimated at £10,300 per annum, the shares were not taken up.

The peculiar feature of Nettlefold's lock (Fig. 10) was, that as

Fig. 10.
Nettlefold's Lock.



the bolt was shot out by the key, two teeth, or quadrants, were projected from the sides of the bolt, which took a firm hold of the plate fixed on the door-post or edge. It was much used for sliding-doors, and was found to answer exceedingly well. The same peculiar movement had also been applied to many other locks, by different makers, under the authority of licences from Mr. Nettlefold.*

Mr. HODGE explained the system he had previously alluded to, as having been employed in America for ascertaining the range of the tumblers. The process was described to be, that the operator, after thoroughly oiling the inside, and inserting two pieces of India-rubber, to limit the sphere of action, injected from a force-pump, a composition of glue and molasses, in a heated state, which chilled quickly, and, although extremely elastic, had the property of retaining the form and position of the lower side, or bellies of the tumblers, and that after being cut out of the lock by a thin-bladed instrument, a key could be made from the impression sufficiently accurate to open the lock. This had repeatedly been done with the best tumbler locks, even on Chubb's principle; although he could not vouch for its having proved successful with any locks made by Mr. Chubb.

The case-hardened iron curtain, he had mentioned, would effectually prevent the success of such a process, for obtaining the range and curve of the bellies of the tumblers.

He thought, that the locks made in New York, were generally superior to those made in England, and he attributed it partly to the use of good machinery, for the production of the parts of the locks, instead of the primitive tools in use at Wolverhampton and other places, and partly to the small expense of patents in America, inducing the exercise of more ingenuity and invention among practical men. At a late exhibition of the American Institute, fifty, or sixty new and ingenious locks, of very superior workmanship, were produced, and he believed that nearly all were invented by practical workmen.

In making these remarks, it was not his intention to detract from the reputation of the late Mr. Chubb, whose ingenuity he much admired, and of whose locks he admitted the general superiority in England; but he must assert, that he had seen more ingenious and better locks in America.

Mr. CHUBB regretted, that what had been stated by Mr. Hodge, had not happened in London, instead of in New York; it must, however, be evident, that such a method was totally incapable of application to a lock of Mr. Chubb's own manufacture, though he

* Nettlefold's lock was patented in 1839, by J. C. Schwieso.

could not answer for the workmanship, or the security of those made by other persons, in imitation of his locks. If a workman did not understand how to make one of his locks, he might leave a similarity between the bellies of the tumblers when at rest, and the steps in the bit of the key, but he denied the possibility of this in any of the locks made by him, and in proof of this, the locks then exhibited were referred to. There was no reason why the bellies of the tumblers should not be perfectly uniform, and in the same plane, and it would be seen from the lock made on that principle, that an impression of the inside of such a lock must be utterly useless for any felonious purposes.

Mr. STEPHENSON, M.P., V.P., said he had been under the impression, that the bellies of the tumblers in Mr. Chubb's lock were always flush, or in the same plane, when the lock was in a state of rest, and that the lift of the tumblers was entirely regulated by the notches, or steps in the key; therefore, it was evident, that unless the impression could be taken from the key, any attempt to make a false key must be futile, and even a fac-simile of the interior of the lock would be useless. When the lower side of the tumblers were flush, as in the lock then produced by Mr. Chubb, it did not seem probable that any scheme could be devised, by which an impression of the lock could afford any assistance for picking the lock.

Mr. FAREY coincided in Mr. Stephenson's opinion, of the improbability of the American plan of taking an impression of the bellies of the tumblers, being at all effective, in aiding to pick a lock really made by Chubb, whatever it might do in the case of bad imitations of that kind of lock.

Mr. WHITWORTH said he had much pleasure in bearing testimony to the great value of Mr. Chubb's locks; he used them almost invariably in his establishment, and never found them get out of order. The workmanship in them was of the best kind, and he thought it would be impossible to pick them, by the means that had been mentioned, or by any picklock keys, as long as the detector was in good order; that was the main feature of the lock, and distinguished it from all other tumbler locks.

Capt. D. O'BRIEN was sorry to differ, in some degree, from the opinion expressed by Mr. Chubb relative to the value of Davis' "Cabinet" locks. The Cabinet boxes frequently contained secret papers, and the promulgation of their contents might be of serious consequence. He formerly had occasion to open from ten to twenty of them daily, during a period of two years, and he never once observed the locks to be out of order; in fact they always appeared to afford great security.

As an Inspector of Government Prisons, his attention had been directed to the subject of secure locks, and he produced specimens of those in use at the Millbank and Pentonville Prisons, which, though not of first-rate workmanship, were tolerably safe, strong, and cheap; most important considerations, when from seven hundred to eight hundred locks had to be provided.

The lock from the Millbank Prison was a good common tumbler lock, with a bolt and a brass guard, in which there was a slot for a pin to slide in, to keep the bolt in its place; it only locked singly, but as yet it had defied ordinary attempts to pick it.

That from the Pentonville Prison was of a better description; it was the invention of Mr. Thomas, of Birmingham, and consisted of a common tumbler, a bolt, and a brass guard flap, retained in position by a spring inserted at the back of the lock. The key, in its revolution, lifted the guard flap, at the same time acting upon the tumbler, which threw the bolt. The lock had also a handle on the outside attached to a trigger, which caught the bolt, when shot back by the key in opening the door, and retained it until the handle was touched, which put the bolt on half lock. This contrivance, the object of which was to save the time of the turnkeys, placed the bolt in such a position, that on closing the door from the inside, the lock could only be opened by the application of the key from the outside, and every prisoner was obliged, by the rules, to touch the handle of the trigger, and thus shut himself into the cell. These locks had been in use eight years, during which period not one had required to be replaced, and any trifling derangements had been made good whilst the prisoners were at exercise. They only cost ten shillings each, notwithstanding that the offers, in the first instance, ranged from twenty-five shillings to forty shillings.

Mr. CHUBB said, he was prepared to produce a workman who would pick any number of Davis' Cabinet locks, of different combinations, which he had never seen before, taking only half an hour for each lock.

He was willing to make the same offer with respect to the locks from the Pentonville Prison; and he might state, that in point of security, he considered them absolutely worthless: in proof of which he exhibited one of them, and a common burglar's tool, by which the lock could be opened with the greatest ease.

Mr. CHARLES HART said, he had some experience in locks, and was conversant with the merits of all the different kinds. From his experience, he considered Chubb's locks were the most secure, and were generally made better than any others. Many inferior locks made on the same principle, were commonly sold, but he had

never yet met with a man who could pick a lock of Mr. Chubb's own manufacture.

Mr. OWEN said, there were one or two incidents connected with the early history of Mr. Chubb's lock which might be interesting.

A convict on board one of the prison ships, at Portsmouth dock-yard, who was by profession a lock-maker, and who had been employed in London in making and repairing locks for several years, and subsequently had been notorious for picking locks, asserted that he had picked, with ease, one of the best of Bramah's locks, and that he could pick Chubb's locks with equal facility. One of the latter was secured by the seals of the late Sir George Grey, the Commissioner, and some of the principal officers of the dock-yard, and given to the convict, together with files, and all the tools he stated to be necessary for preparing false instruments for the purpose; as also blank keys to fit the pin of the lock, with a lock exactly the same in principle, so that he might examine it, and make himself master of its construction: promises of a reward of £100 from Mr. Chubb, and of a free pardon, were also made to him in the event of his success.

After trying for two, or three months, to pick the sealed lock, during which time, by his repeated efforts, he repeatedly overlifted the detector, which was as often undetected, or re-adjusted, for his subsequent trials, he gave up the attempt, saying that Chubb's were the most secure locks he had ever met with, and that it was impossible for any man to pick, or to open them, with false instruments.

In order to compare the merits of Bramah's and of Chubb's locks, Mr. Owen had suggested a mechanical contrivance, which was applied to one of Bramah's six-spring keyed padlocks, belonging to the Excise. It was hung upon a nail, in a vertical position, secure from side oscillation; a self-acting apparatus was then applied, consisting of a pipe with hexagonal grooves, and a stud, or bit, corresponding with the divisions of the lock, and secured to it by a spring; in the grooves of this pipe, small slides were inserted, which pressed against the spring keys of the lock; to these slides were attached levers, acted upon by eccentrics, moved by a combination of wheels, whose teeth varied in number by one (or a hunting tooth), so as to perform the permutation required for the different depths of the spring keys, corresponding with those of the proper key to the lock; when, by the automaton machine being set in motion from a weight and line over a barrel, and so left, the combination was attained, which occupied from half an hour to three hours, according to the state of permutation, the position of the

eccentrics were in, at the time of the introduction into the lock, of the pipe, or false key, to which was attached a rod and weight at right angles to it, the notches in the spring keys being brought in a line with the plane of the plate, or diaphragm of the lock, the rod and weight turned the false key, or pipe, opened the lock, and stopped the further motion of the automaton. In that state, the slides indicated the exact depth of the grooves of the proper key, and gave the form of a matrix, by which to make a key similar to the original one.

In order to ascertain the result of friction on Chubb's detector lock, one of them was subjected to the alternate rectilinear motion of a steam-engine, in the Portsmouth dock-yard, and was locked and unlocked upwards of four hundred and sixty thousand times consecutively, without any appreciable wear being indicated by a gauge applied to the levers and the key, both before, and after this alternate action.

He believed Chubb's locks had never been picked; the detector was the main feature of its excellence; and additional precaution, therefore, was only departing from its simplicity, and adding to the expense without any commensurate advantage.

Mr. FAREY said, before closing the discussion, he desired to direct attention to the importance of the means of securing iron chests, or safes. The bolts should be so arranged as to shoot out from all the four sides of the door (Fig. 8, p. 329), by the action of a handle, which should be secured from being opened by one, or two small locks; this was a much safer plan than having large keys, capable of throwing the bolts, as the large keyholes and greater space within the locks, afforded facilities for tampering with them.

The letter locks, which had been only cursorily alluded to, were invented by Cardon, who advanced no further than using one word; they were improved by Regnier, who placed the letters on moveable rings, so as to permit a great extent of permutation. These locks were, however, not safe, as they might be easily picked, by suspending a weight on the hasp, and turning round the rings seriatim, until it was felt that the combination was arrived at, by the pin holding in the notch of the ring.

Mr. STEPHENSON, M.P., V.P., said it might be assumed as proved from the discussion, and therefore it was the duty of the Institution to express the conviction, that no locks really made by Chubb, had ever been picked, either in Great Britain or on the other side of the Atlantic; that they did, in fact, combine that strength, simplicity, easy action, and security, without which the most ingenious locks were utterly useless.

Notwithstanding the circumstantial description of the ingenious method employed in the United States, for taking an impression of the interior of a lock, it had not been proved to have been successful with one of Chubb's locks; and indeed, he must repeat, that it was evident it could not be so, unless the lift of the tumblers was identical with the position of the bellies, when in a state of rest, which was not the case; and if the bellies of the tumblers were flush, an impression of them was still more useless.

The thanks of the Institution were most justly due to Mr. Chubb, for bringing before the Members so interesting a subject, which he had treated in so able a manner.

Mr. CHUBB said, with respect to the locks which had been stated to have been picked, he could assure the Members that they had never been issued from his manufactory, although they were very probably marked with his name. Many spurious imitations of the first expired patent, marked "Chubb's Patent," had been sold in large quantities, until the makers were stopped by legal process, when it was ruled, both at law, and equity, that, although after the expiration of a patent, any person might manufacture the article, he had no right to pirate a peculiar trade mark, or to use a distinctive stamp, which was irrespective of any patent right.

Since he had been connected with the Institution, he had derived so much pleasure, instruction, and profit from it, that he felt it equally a pleasure and a duty to communicate the paper which had been so fortunate as to receive the approbation of the Members.

In closing the discussion he might be permitted, as the result of his practical experience, to state that, as Mr. Stephenson had ably expressed it, the main features of a good lock were security, simplicity, and strength; if these were wanting, however ingenious an invention might be, it was for all practical purposes worthless.

A manufacturer should never, through fear of competition, reduce the quality, of either the materials, or the workmanship of his locks; but should study to produce the best of whatever kind he manufactured.

Masters should treat their workmen as men ought to be treated, and if a high character of work was required, good wages must be paid; for if the workmen saw that a master cared for them, and took an interest in their welfare, they would have an equal pride with himself in the character of the manufacture, and would strive faithfully to maintain his reputation, by the utmost exertion of that skill and ingenuity, for which the British handicraftsmen were so justly celebrated.