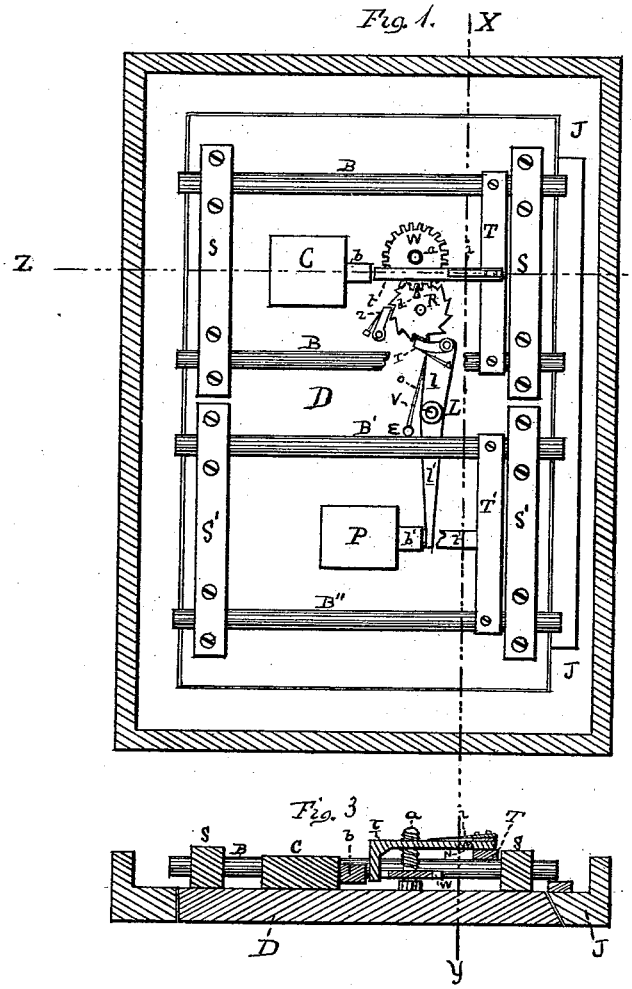
S. M. LILLIE.

Locking-Mechanism for Safe and Vault Doors.

No. 212,101. Patented Feb. 11, 1879.

Fig. 1.



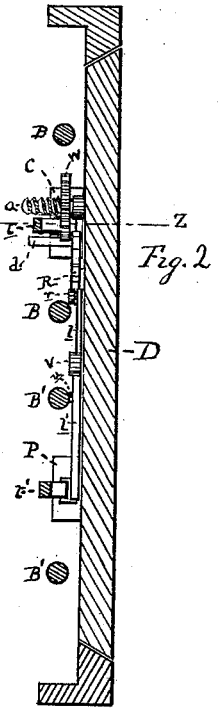


Fig. 2

Fig. 3

Fig. 4.

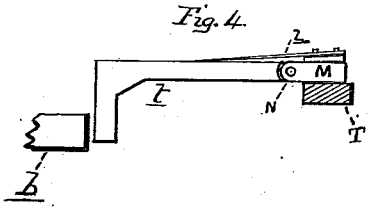
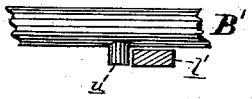


Fig 5



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IMPROVEMENT IN LOCKING MECHANISMS FOR SAFE AND VAULT DOORS.

Specification forming part of Letters Patent No. **212,101**, dated February 11, 1879; application filed June 26, 1878.

To all whom it may concern:

Be it known that I, S. MORRIS LILLIE, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in Locking Mechanisms for Safe and Vault Doors, of which the following is a specification:

The invention relates to those arrangements of the locking apparatus of safe and vault doors in which two locks are used, ordinarily a permutation-lock and a time-lock, and which require that both locks shall be unlocked before the safe or vault door may be unlocked and opened.

The locks are usually used in connection with a set of bolts termed the "train-bolts," which are thrown to lock the door by means of a spindle passing through the door, and are held in the locked position by the locking of either or both of the locks, and which cannot be unlocked until after both locks have been unlocked. Sometimes each lock is used in connection with a separate set of bolts or locking mechanism, both sets being thrown by one spindle, or else each set is thrown by its own spindle; but, whatever may be the disposition, both locks have to be unlocked before the door can be opened.

With locking mechanisms arranged to be thus used in connection with two locks, one a permutation-lock and the other a time-lock, it occasionally occurs that the time-lock becomes inoperative and fails to unlock, leaving the door locked, and the result is a "lock-out."

The object of my invention is to provide means, whatever may be the arrangement, whether the locks are used in connection with separate locking mechanisms or with the same mechanism, whereby, in case the time-lock fails to unlock, the locking apparatus held by it may, in a greater or less time after the combination-lock has been unlocked, be disconnected from it, so that it may be unlocked and the door opened while the time-lock remains locked, so that a time-lock lock-out would be impossible.

The invention consists in connecting either the spindle of the combination-lock or the spindle of the locking mechanism used with that lock, by suitable mechanism, with the locking apparatus used with the time-lock, so that after the combination or permutation lock has been unlocked the former may be released from the control of the latter by means of that spindle with which the connection is made.

In the accompanying drawings, in which like letters indicate like parts, Figure 1 shows the back of a safe-door on which is mechanism embodying my invention. Fig. 2 is a section of Fig. 1, along the broken line *z z*. Fig. 3 is a section of Fig. 1 along the broken line *x y;* and Figs. 4 and 5 are drawings of detached parts.

The arrangement of the locking apparatus of the safe-door shown in the drawings consists of two distinct sets of bolts, one being used with the time-lock and the other with the combination-lock; and there is also shown one manner of making the connection between the bolts used with the time-lock and the spindle of the combination-lock; and one manner of making the connection with the spindle by which the set of bolts used with the combination-lock is thrown.

D, Figs. 1, 2, and 3, is the door of the safe, and J J is the jamb. B, B, B′, and B″ are four bolts, joined in pairs by the tie-bars T T′. The upper two bolts, B B, are joined by the tie-bar T to form one pair or set, and the lower two, B′ B″, are joined by the tie-bar T′ to form the second pair or set.

The upper set of bolts is held to the door by the staple-bars S S, and the lower set by the staple-bars S′ S′. No means of moving or "throwing" these sets of bolts is shown, and it may be supposed either that each set is thrown by a separate spindle passing through the door, or that both sets are thrown by the same spindle, the latter arrangement being such that the sets of bolts may be thrown independently of each other—as, for example, the bolts used with the combination-lock may be thrown so as to unlock the door without so throwing the set of bolts used with the time-lock. This arrangement is not a hypothetical one, but is one that is easily made; and that is, so far as the principle of the arrangement is concerned, in practical use on safes and vaults.

C, Figs. 1, 2, and 3, is the chronometer or time lock, which clogs the upper set of bolts, and

b is its bolt. P, Figs. 1 and 2, is the permutation or combination lock, that clogs the lower set of bolts, and *b'* is its bolt. *t*, Figs. 1, 2, 3, and 4, is a tongue, which is fastened to the tie-bar T of the upper set of bolts, and extends back toward the time-lock C, and bears against the end of its bolt *b*. *t'*, Figs. 1 and 2, is a tongue, which is fastened to the tie-bar T' of the lower set of bolts, and extends back toward the combination-lock P, and abuts against the end of its bolt *b'*, as shown in Fig. 2. In Fig. 1 the tongue *t'* is represented as broken away, in order to show mechanism underneath it. Only when the time-lock C is unlocked, which it is supposed effects the retraction of its bolt *b*, or else leaves it free to be pressed back, can the upper set of bolts be thrown back or unlocked, and, similarly, only when the combination-lock P is unlocked can the lower set of bolts be unlocked. In the drawings both sets of bolts, and also the two locks, are represented as locked.

The tongue *t*, which extends from the tie-bar T of the upper set of bolts, and abuts against the end of the time-lock bolt *b*, is hinged to the tie-bar T, Figs. 3 and 4, or rather to a block of metal which is fastened upon the upper surface of the tie-bar, so that the end of it that bears against the end of the bolt *b* of the time-lock may be raised, so that it will no longer have any such bearing, in which case the time-lock will cease to have any clogging control over its set of bolts, and the latter will be free to be thrown back by its spindle, or by the spindle common to the two sets, as the case may be. The tongue *t* and its hinged attachment to the tie-bar T is more plainly shown in Fig. 4, which shows the tongue *t*, a portion of the bolt *b* of the time-lock, and a section of the tie-bar T. M, Fig. 4, is a block of metal firmly fastened upon the upper surface of the tie-bar, and to which is hinged at N the tongue *t*, that extends back to the bolt *b* of the time-lock. The tongue *t* is held in the position shown in the drawing—viz., so that it bears against the end of the time-lock bolt—by the spring *i*, Figs. 1, 2, and 3, one end of which is fastened upon the upper surface of the block of metal M, while the other exerts a downward pressure upon the tongue, and tends to keep it pressed in toward the door of the safe. The hinged tongue *t*, the gear-wheel W, and its arbor *a*, Figs. 1, 2, and 3, the ratchet-wheel R, Figs. 1 and 2, the lever L, Figs. 1 and 2, and the bolt *b'* of the combination-lock form together a train of mechanism which, as hereinafter described, connects the spindle of the combination-lock with the set of bolts clogged by the time-lock, so that they may be released from this clogging control by means of the said spindle, the combination-lock having been unlocked. Omitting the bolt *b'* of the combination-lock, the same elements, in conjunction with the set of bolts that is clogged by the combination-lock, form a train of mechanism which connects the spindle by which the said bolts are thrown with the set of bolts that is used with the time-lock, so that they may be released from the clogging control of the time-lock by means of the said spindle after the combination-lock has been unlocked, all as hereinafter described.

The arbor *a* of the gear-wheel W, Figs. 1, 2, and 3, is firmly attached to the door D, and extends perpendicularly from it to a short distance beyond the upper surface of the tongue *t*. It is located on the door above the tongue *t*, and at such a point that the wheel W extends underneath and protrudes below the tongue. The arbor *a* is threaded, and also the hub of the wheel W, so that if the latter is revolved on it it will either rise or fall on the arbor, as the case may be. If it be revolved in the direction that causes it to rise a sufficient number of times it will come to bear against the under surface of the tongue *t*, and if the revolution be continued it will raise the tongue so that its end will no longer bear against that of the bolt of the time-lock, and the upper set of bolts will then be free to be thrown back independently of the time-lock. The arbor *a* is not threaded down to its juncture with the door, and between the point where the thread ceases and the surface of the door the arbor is of a larger diameter than it is above that point, so that there is formed a shoulder upon it, against which the wheel W rests when screwed down the arbor as far as it can be, as shown in Figs. 2 and 3. When thus screwed down there is sufficient space between it and the door for the ratchet-wheel R, Figs. 1 and 2, which is pivoted to the door below the wheel W, and at such a point that it extends underneath the wheel W.

On the upper surface of the ratchet-wheel R is a pin, *d*, Figs. 1 and 2, so located upon it that as the ratchet-wheel is revolved by the lever L and the lock or train-bolt spindle, as hereinafter described, it engages the teeth on the gear-wheel W, and causes the latter to revolve one tooth for each revolution of the ratchet-wheel, so that if the wheel W had sixty cogs it would require sixty revolutions of the ratchet-wheel to produce one revolution of the wheel W. The pin *d* extends above the surface of the ratchet-wheel far enough so that it will continue to engage the teeth of the wheel W, however far the latter may have risen on the arbor *a*, so that a continued revolution of the ratchet-wheel R in the proper direction would cause the wheel W to rise on the arbor *a* until it would finally engage and raise the end of the tongue *t*, so that it would no longer bear against the end of the time-lock bolt *b*, as hereinbefore described.

L, Figs. 1 and 2, is a lever pivoted to the door at *v* below the ratchet-wheel R, and having an arm, *l*, which extends up toward the ratchet-wheel, passing underneath the lower bolt, B, and an arm, *l'*, which extends down, passing beneath the bolt B', and bears against the end of the bolt *b'* of the combination-lock P.

The upper end of the arm *l* bears the ratchet *r*, which engages the spurs on the circumference of the ratchet-wheel R, so that one vibration of the arm *l* causes the latter to revolve one spur.

The spring *o*, Fig. 1, fastened at one end to the door at *e*, presses with its free end against one edge of the upper arm, *l*, in such a manner as to keep the end of the lower arm, *l'*, pressed against the end of the bolt *b'* of the combination-lock P, so that when the bolt *b'* is drawn into the lock by the unlocking of the same the end of the lever *l'* follows it, while the end of the lever *l* moves in the contrary direction, and the ratchet upon it engages a fresh spur on the ratchet-wheel R. The throwing out of the bolt *b'* of the combination-lock reverses the above motions of the arms *l* and *l'*, and the ratchet upon the former revolves the ratchet-wheel the distance between two of its spurs. Thus by a double throw of the bolt of the combination-lock—that is, a throw in and a throw out—one complete vibration of the lever L and of its arm *l* is given, and the ratchet-wheel is thereby revolved one spur, and in such a direction that the motion imparted by it to the wheel W will cause the latter to rise on its arbor *a*.

By a throwing in and out of the combination-lock bolt *b'* continued sufficiently long the ratchet-wheel R, and consequently the gear-wheel W, will be gradually revolved until the latter will finally engage the under surface of the tongue *t* and raise the end of it until it will no longer bear against the end of the bolt *b* of the time-lock, and the latter will then no longer have any control over the motions of the set of bolts used in connection with it, and they may then be thrown back to unlock the safe-door, even though the time-lock is not unlocked. But the throwing in and out of the bolt *b'* of the combination-lock P is effected by the spindle of the latter, and can only be done after the combination of the lock has been worked, which constitutes the unlocking of the lock.

Thus I have shown and described a train of mechanism connecting the spindle of the combination-lock P in such a manner with the set of bolts that is used with the time-lock that the latter may be freed from the control of the time-lock by means of the said spindle after the combination-lock has been unlocked, and in a time thereafter that will depend upon the number of spurs on the ratchet-wheel R, the number of teeth on the gear-wheel W, and upon the distance that the latter has to rise upon its arbor *a* before it will disengage the end of the tongue *t* from the end of the time-lock bolt *b*. The time thus required may be made to be anything within the limits of the mechanism by properly setting the wheel W on its arbor *a*. The higher it is set on the arbor the less will be the time required.

It is plain that the working of the mechanism shown would not be at all altered if the four bolts B, B, B', and B'' were joined by one tie-bar to form one set of bolts, instead of being joined in two pairs by two tie-bars, one pair being used with the time-lock and the other with the combination-lock.

I do not wish to be limited to the particular means shown for releasing the set of bolts from the control of the time-lock through the medium of the combination-lock spindle, for it must necessarily vary with the arrangement of the bolt-work on the safe door and with that of the combination-lock used, so that in applying my invention to two different safe-doors the mechanism by which the purpose is accomplished on one door may be very different from that by which it is accomplished on the other. For example, in many combination-locks there is no such bolt as *b'*, and consequently none through which a connection could be made with the lock-spindle in precisely the same manner as shown in the drawings, and the connection with the spindle would have to be made in a manner depending upon the construction of the combination-lock.

It now remains to describe the means by which the set of bolts used with the time-lock may be released from the control of the latter by means of the spindle of the bolts used with the combination-lock, the combination-lock having been first unlocked.

As before remarked in this specification, the two sets of bolts may be arranged to be thrown by separate spindles, or by the same one.

The same train of mechanism, consisting of the hinged tongue *t*, the gear-wheel W, and its arbor *a*, the ratchet-wheel R, and the lever L, bearing the ratchet *r*, already described for connecting the spindle of the combination-lock with the set of bolts used with the time-lock, is used for connecting the spindle that throws the bolts used with the combination-lock with the bolts used with the time-lock, the only variation being that the vibration of the lever L is effected by means of the spindle of the bolts used with the combination-lock P instead of by the spindle of the lock itself, and in the following manner: On the under side of the bolt B' of the set of bolts used with the combination-lock is a lug so located that when the bolts are thrown into the locked position, as shown in the drawings, it bears against the edge of the lower arm, *l'*, of the lever L, and revolves the lever into the position shown, which presses back the spring *o;* and when the bolts are thrown back again into the unlocked position, it allows the spring *o* to press back the upper arm, *l*, into the position in which it was before the bolts were thrown into the locked position. Thus the throwing back and forth of the set of bolts used in connection with the combination-lock vibrates the lever L, and thereby causes the revolution of the ratchet-wheel R and of the gear-wheel W, which latter gradually rises on the arbor *a* until it engages and lifts the hinged tongue *t*

until it ceases to bear against the end of the time-lock bolt, in consequence of which the time-lock no longer clogs the bolts used in connection with it, and they may be thrown back by their spindle, even though the time-lock is not unlocked. Thus, by means of the hinged tongue *t*, gear-wheel W, ratchet-wheel R, lever L, and the set of bolts used in connection with the combination-lock, a connection is made between the spindle by which those bolts are thrown and the set of bolts used with the time-lock, whereby the latter may be released from the control of the time-lock by the said spindle; and as the spindle cannot throw its bolts until after the combination-lock has been unlocked, this cannot be effected until after that lock has been unlocked.

It does not matter, in the working of the mechanism shown, whether each set of bolts is thrown by a separate spindle or by a spindle common to both, so long as the bolts used with the combination-lock may be thrown independently of those used in connection with the time-lock.

When the two locks are used with one set of train-bolts, as is usually the case, and which would be represented by the drawings if the two tie-bars T and T′ were joined, or were continuous, so as to form one tie-bar, joining the four bolts together to form one set, it would only be necessary to have a little play between the end of the tongue *t* and that of the time-lock bolt, so that after the combination-lock was unlocked there might be a little play to the train-bolts, though the time-lock was not unlocked, and then the mechanism shown could be operated by the train-bolt spindle after the combination-lock had been unlocked, as already described; for, however small this play might be, the lengths of the two arms *l* and *l′* of the lever L could be so proportioned that it would be sufficient for the purpose of operating the mechanism. Or, again, where the two locks are used in connection with one set of bolts, one of the arms, *l* or *l′*, of the lever L might be connected directly by means of a connecting-rod or otherwise with an arm or "switch," as it would be technically called, on the inner extremity of the train-bolt spindle, and the latter so arranged in connection with the train-bolts and combination-lock that after the unlocking of the latter the spindle would have sufficient play, independent of the train-bolts, to work the lever L and the mechanism of which it forms a part.

I wish to be protected against the use not only of the particular mechanism shown for connecting the spindle of the bolts used with the combination-lock and the bolts used with the time-lock, for the purpose hereinbefore stated, but also against the use of any mechanism for the purpose; for the essence of my invention consists in connecting the said spindle with the said bolts, for the purpose specified, and not in any particular manner of making the connection, for that may be varied indefinitely, and would of necessity vary with the arrangement of the bolt-work on the safe-door to which my invention was applied. Nor where each lock is used with a separate locking mechanism do I wish my protection limited to the use of my invention in connection with the particular mechanisms shown—that is, in connection with a set of bolts, B B, used with the time-lock, and a set, B′ B″, used with the combination-lock; for, in making the drawings accompanying this specification, it was my object to make a disposition of the locking mechanisms that would be simple, and in connection with which my invention could be easily shown, and not necessarily one that would be likely to be used in practice.

I do not wish to be understood as claiming as my invention the use of an extra spindle or lock whose special function it is to disconnect the locking mechanism of a safe or vault door from the time-lock, and which does not require the previous unlocking of the combination-lock by which the locking mechanism of the door is clogged.

What I claim as my invention is—

1. The combination, on a safe or vault door, of a time-lock and a combination-lock, both of which must be unlocked before all of the locking apparatus may be unlocked and the door opened, and of a mechanism consisting of the hinged tongue *t*, gear-wheel W, and arbor *a*, ratchet-wheel R, and pin *d*, and the lever L, with one of the spindles passing through the door, so that the locking apparatus of the door may in time, after the unlocking of the combination-lock, be released by means of the said spindle from the clogging control of the time-lock, so that it may be unlocked independently of the time-lock and the door opened, substantially as and for the purpose specified.

2. The combination, on a safe or vault door, of a time-lock and a combination-lock, both of which must be unlocked before all of the locking apparatus may be unlocked, and of one of the spindles passing through the door, the locking apparatus clogged by the time-lock, and intermediate mechanism connecting the two and operating to disconnect the said locking apparatus from the time-lock on the repeated turning of the said spindle after the unlocking of the combination-lock, so that the said locking apparatus may be unlocked and the door opened independently of the time-lock, substantially as herein set forth.

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Witnesses.

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