

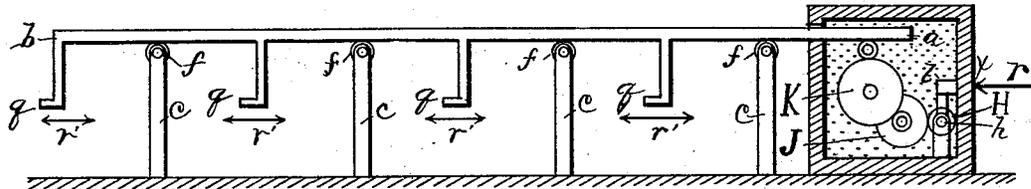
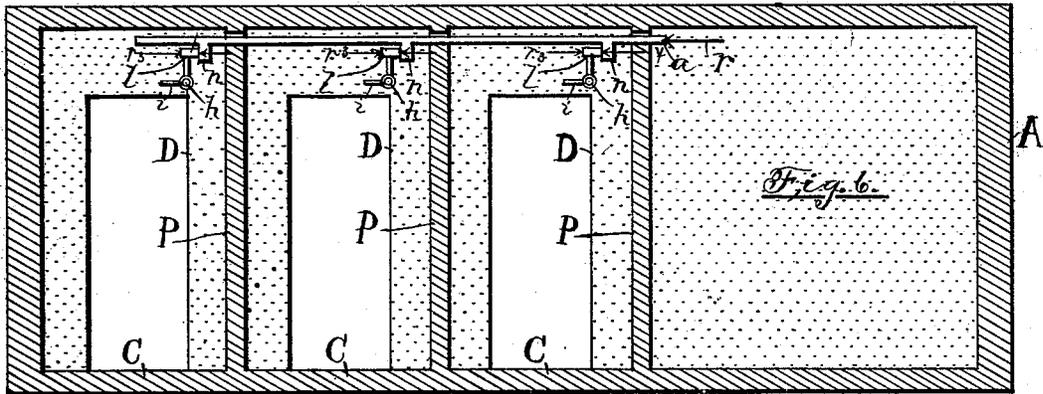
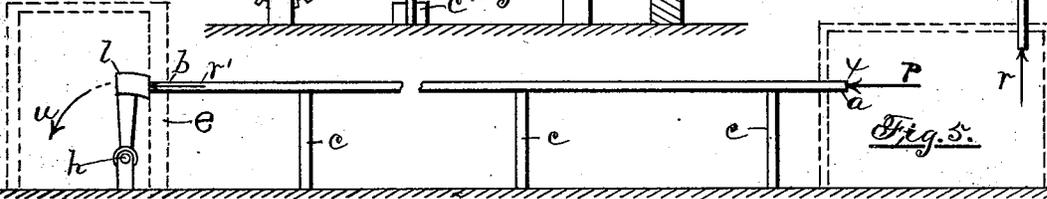
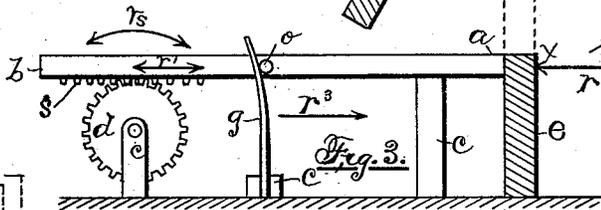
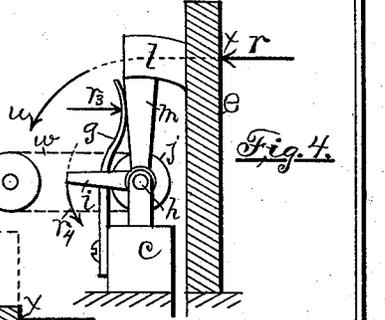
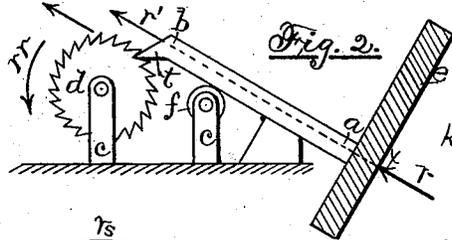
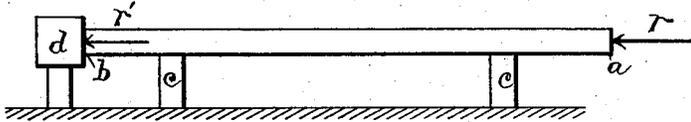
M. A. DALTON.

METHOD OF AND APPARATUS FOR CONTROLLING AND UTILIZING CONCUSSION AND APPLYING IT TO SAFE LOCKS.

No. 508,902.

Patented Nov. 14, 1893.

Fig. 1.



Witnesses,
Edward P. Robbins
Charles H. Roth.

Fig. 7.

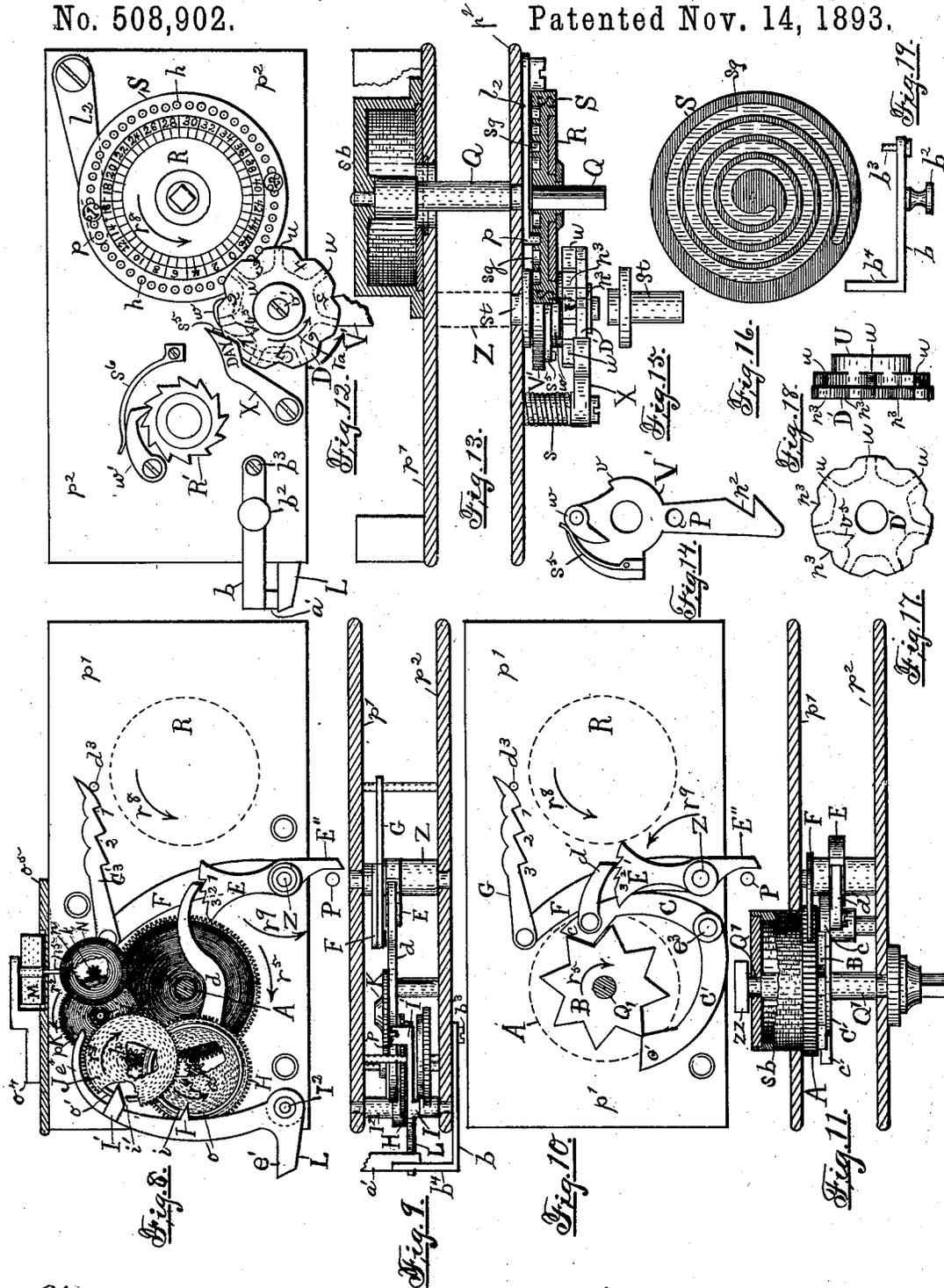
Inventor,
Milton A. Dalton

M. A. DALTON.

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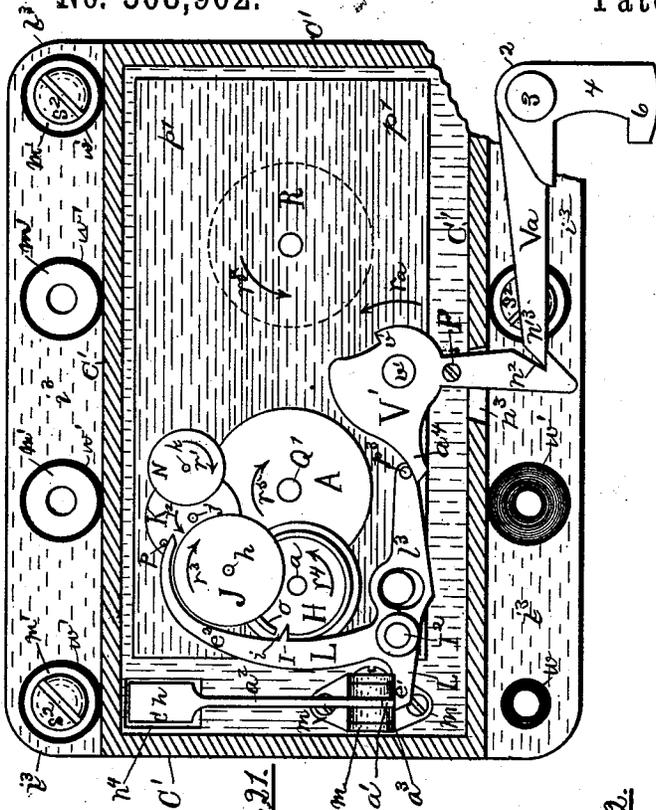


Fig. 21.

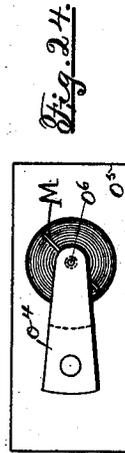


Fig. 24.

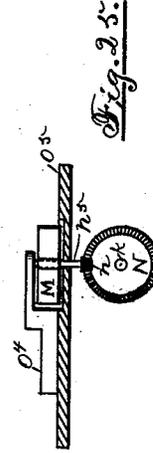


Fig. 25.

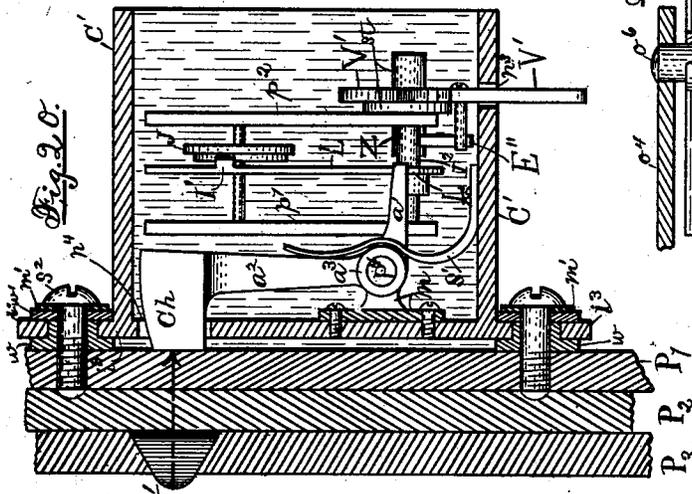


Fig. 20.

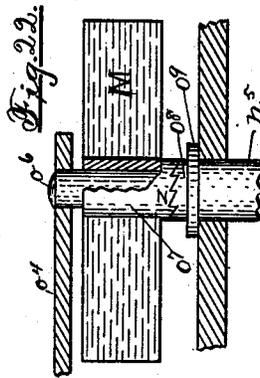


Fig. 22.



Fig. 23.

Witnesses:
 Edward O. Robbins,
 Charles H. Roth.

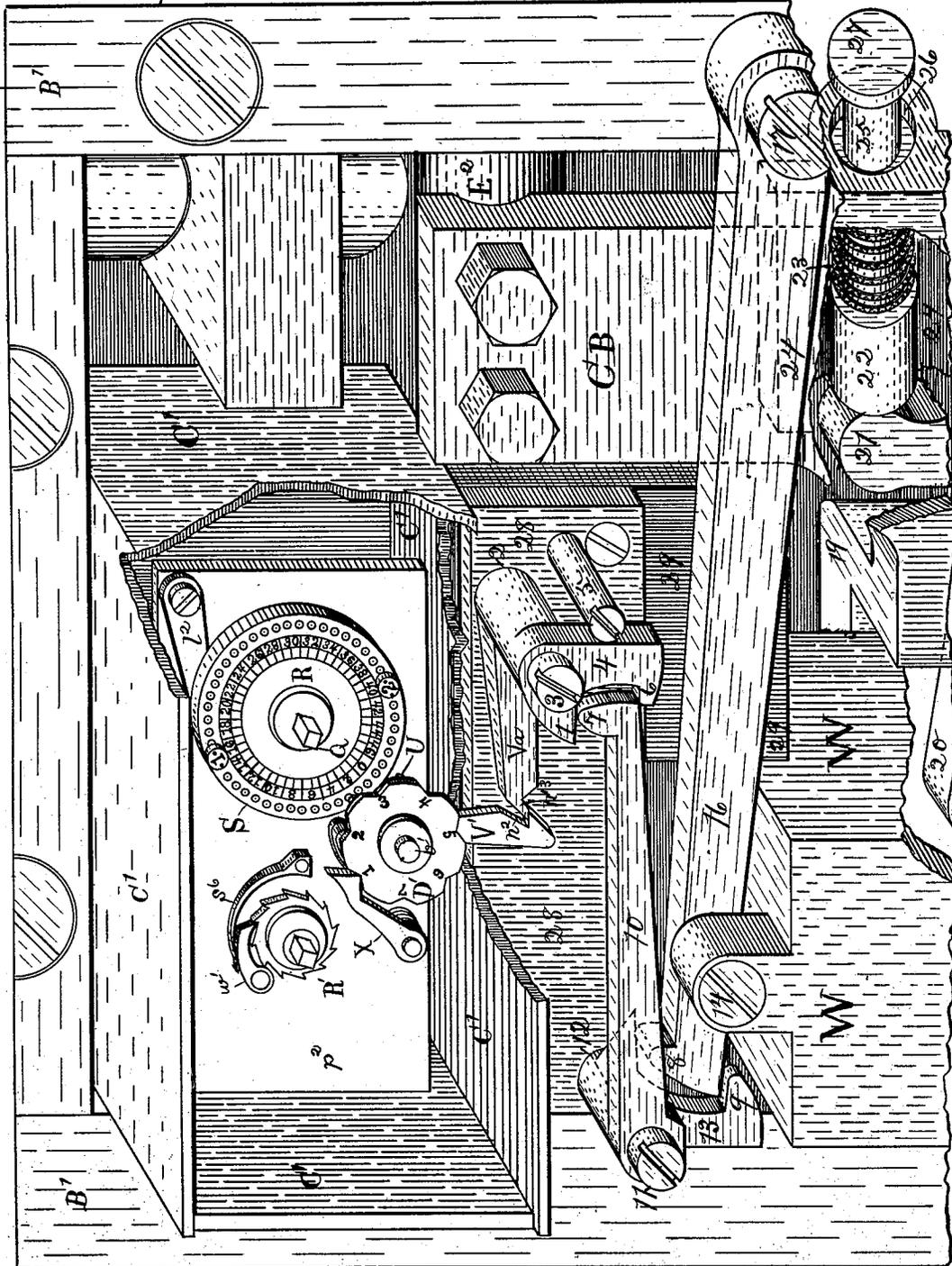
Inventor:
 Milton A. Dalton

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Fig. 26.

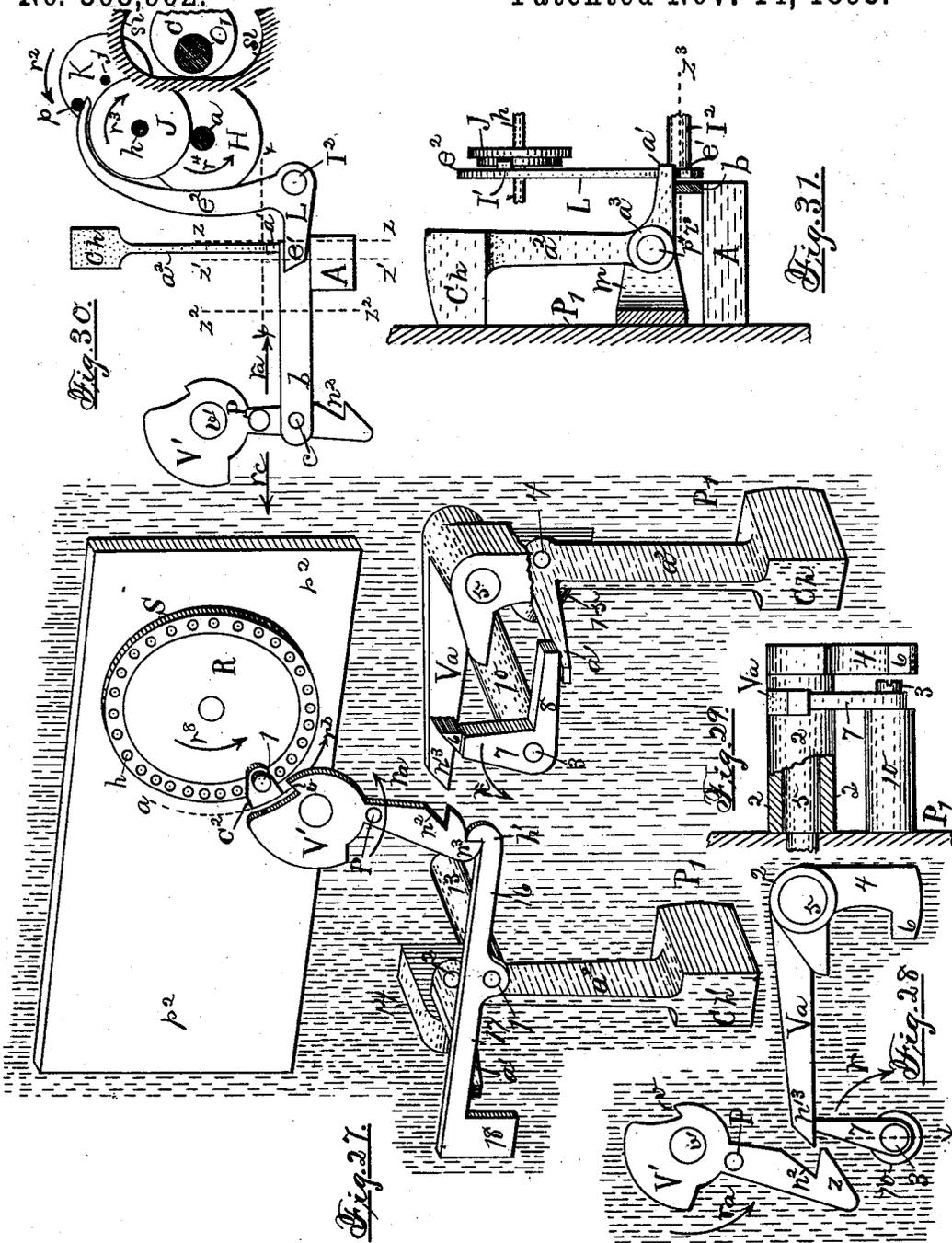
Inventor
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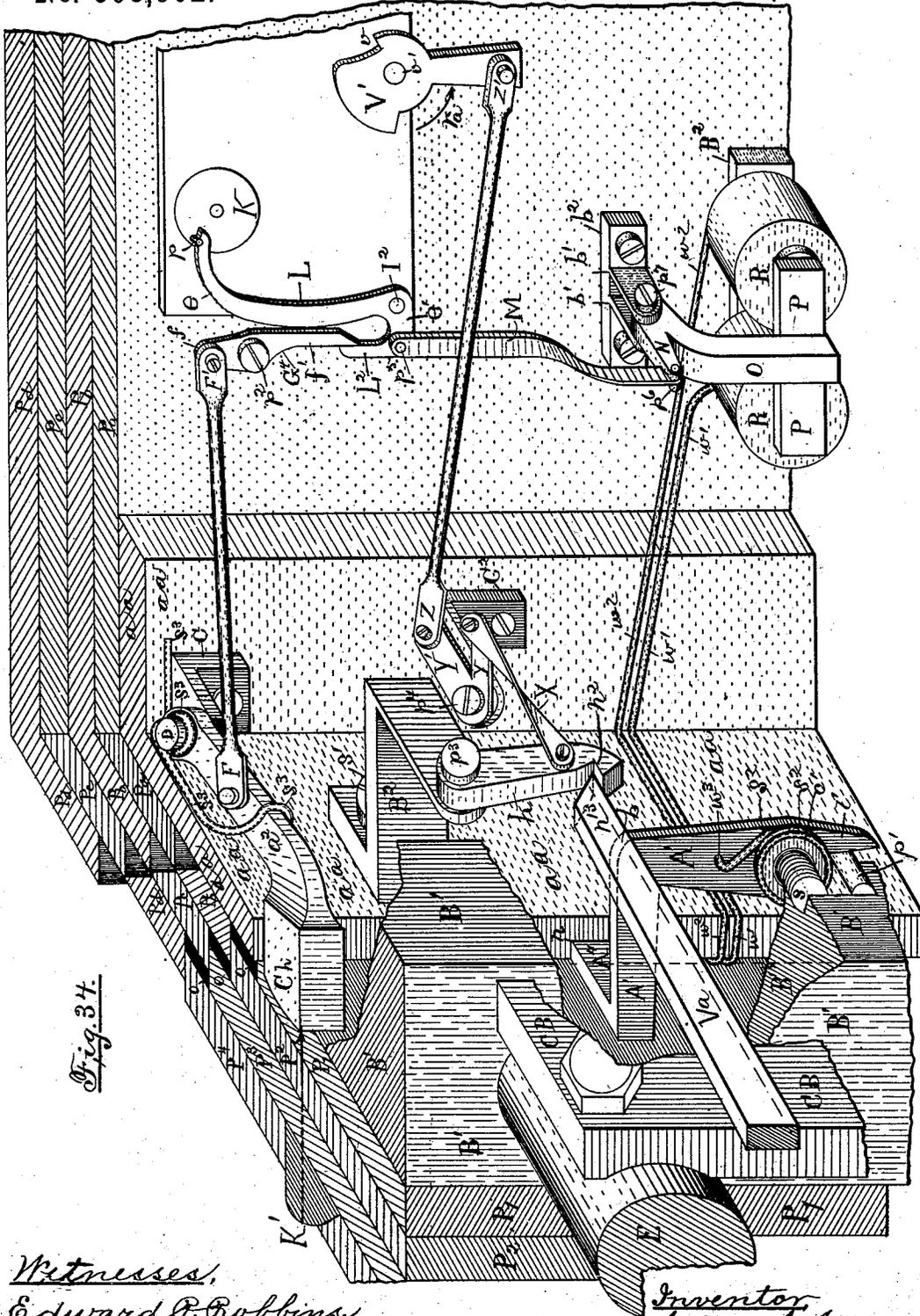


Fig. 34.

Witnesses,
 Edward P. Robbins
 Charles H. Roth.

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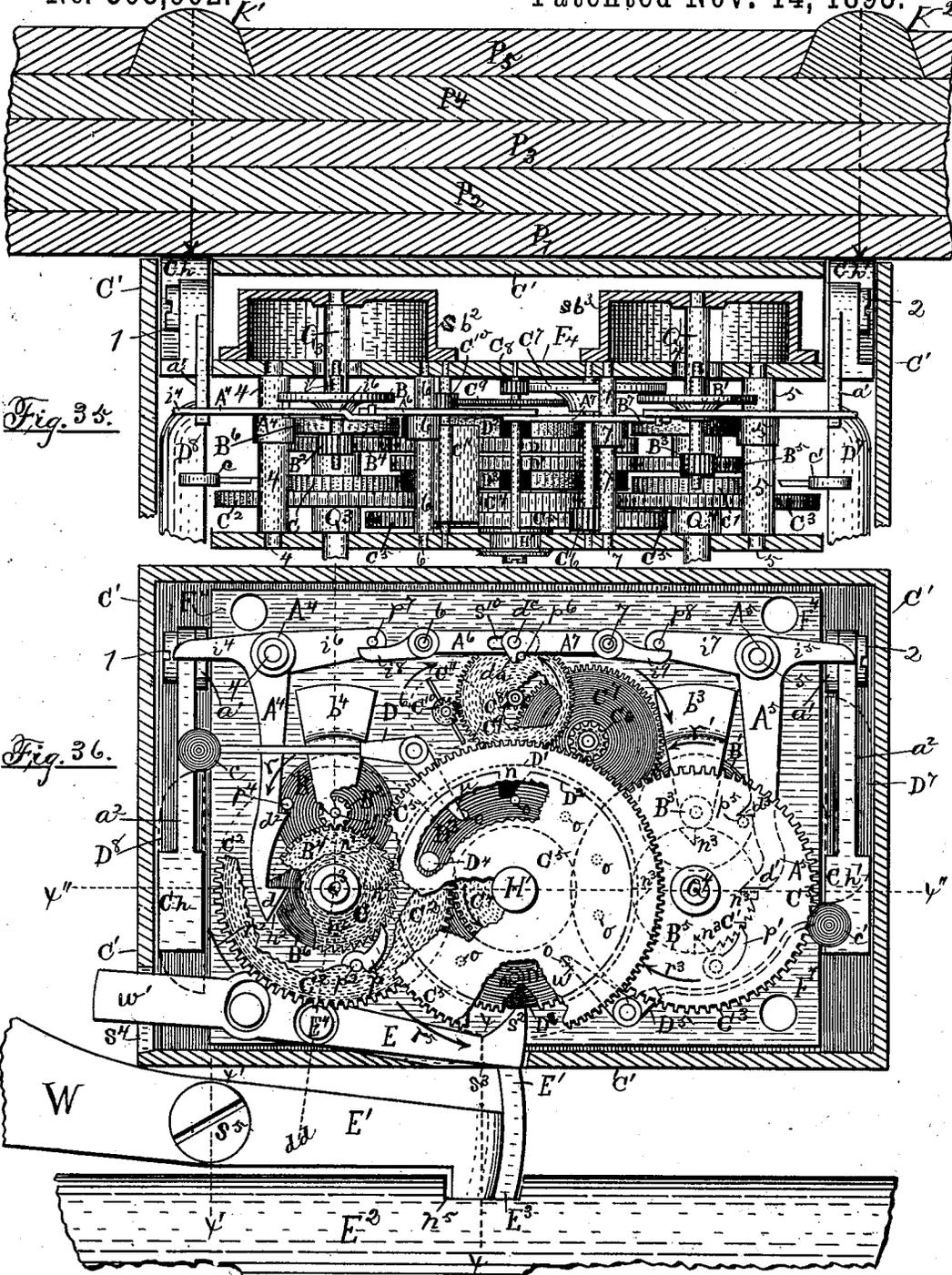


Fig. 35.

Fig. 36.

Witnesses:
 Edward P. Robbins
 Charles H. Roth.

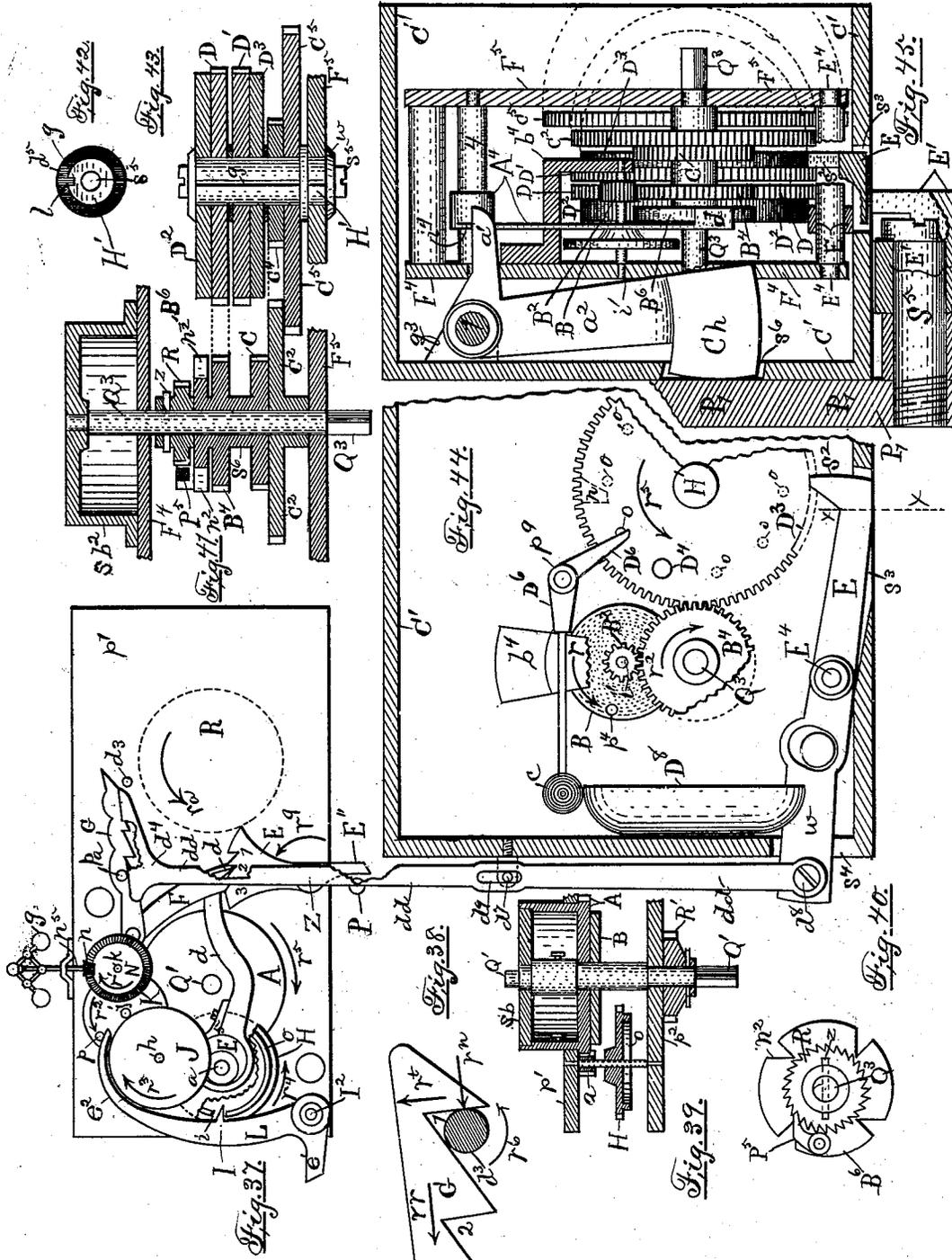
Inventor:
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Witnesses

*Edward P. Robbins,
Charles H. Roth.*

*Inventor
Milton A. Dalton*

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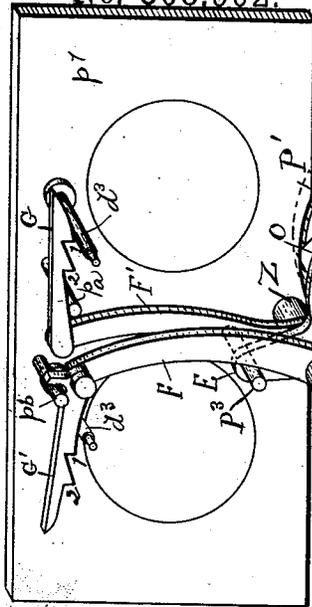


Fig. 81.

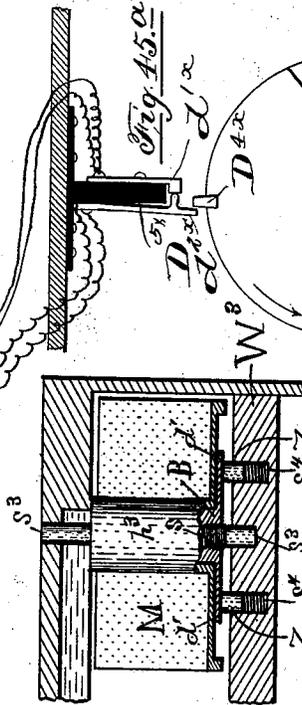
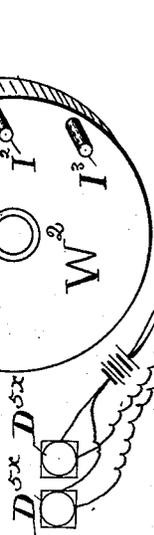


Fig. 80.

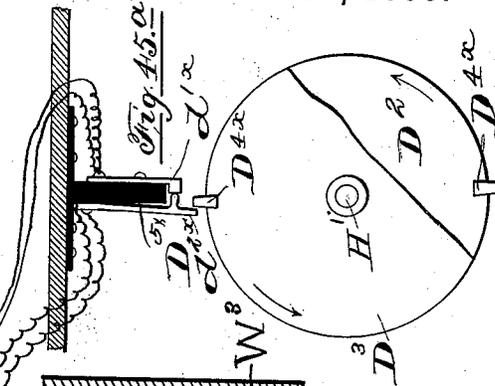
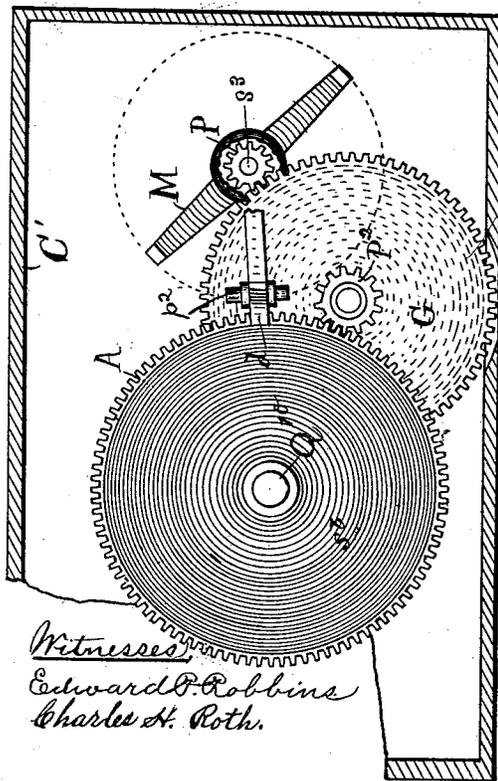


Fig. 45.

Fig. 77.



Witnesses,
 Edward P. Robbins
 Charles H. Roth.

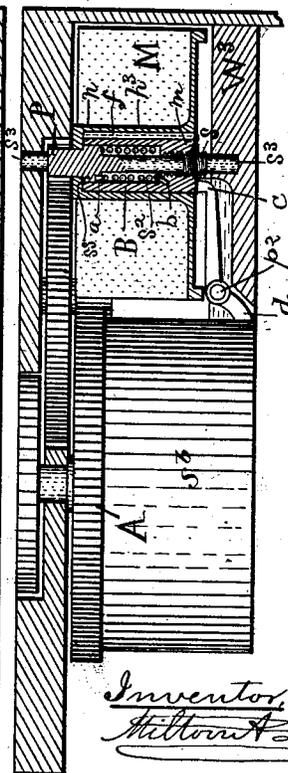


Fig. 78.

Inventor,
 Milton A. Dalton



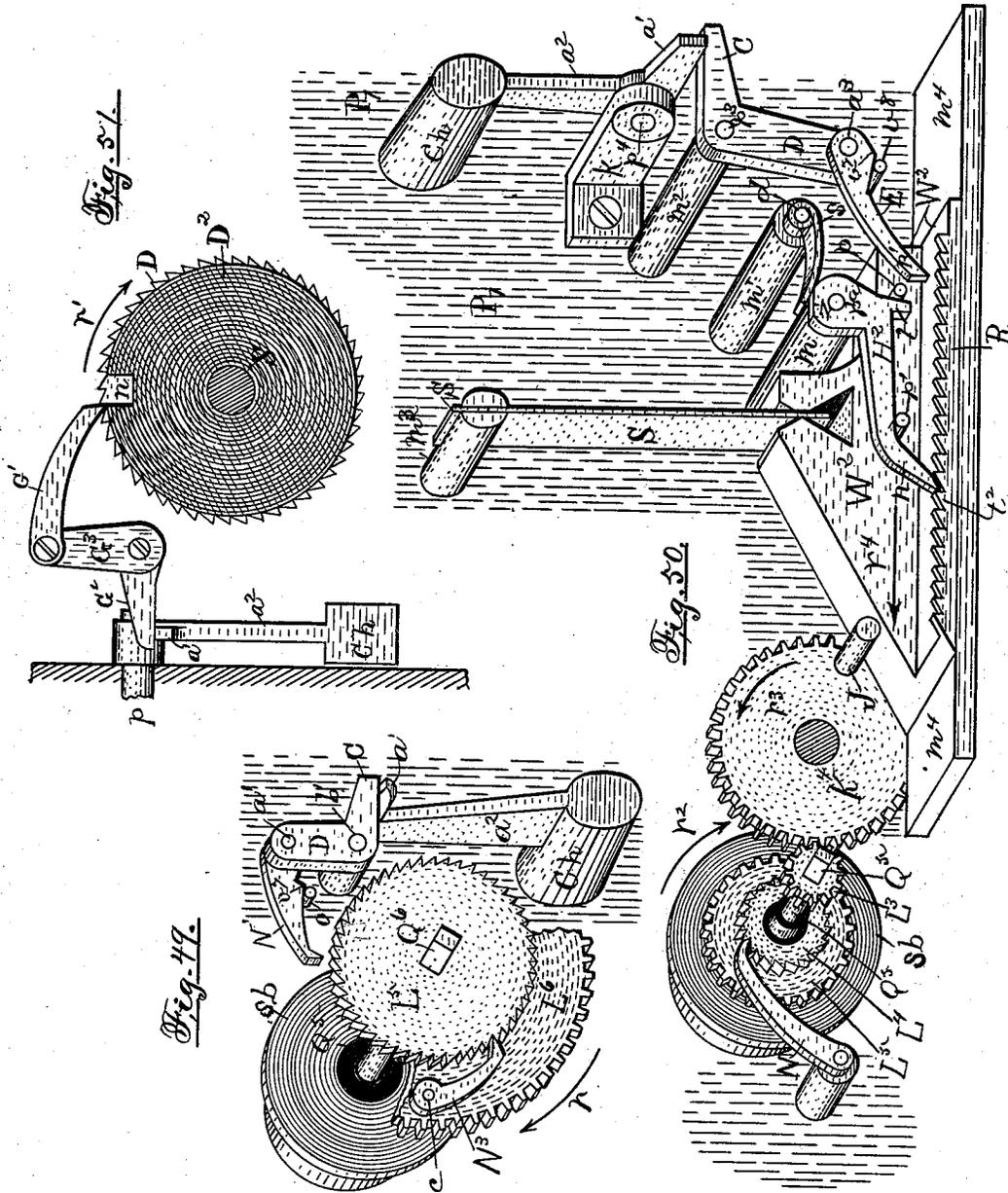
Fig. 79.

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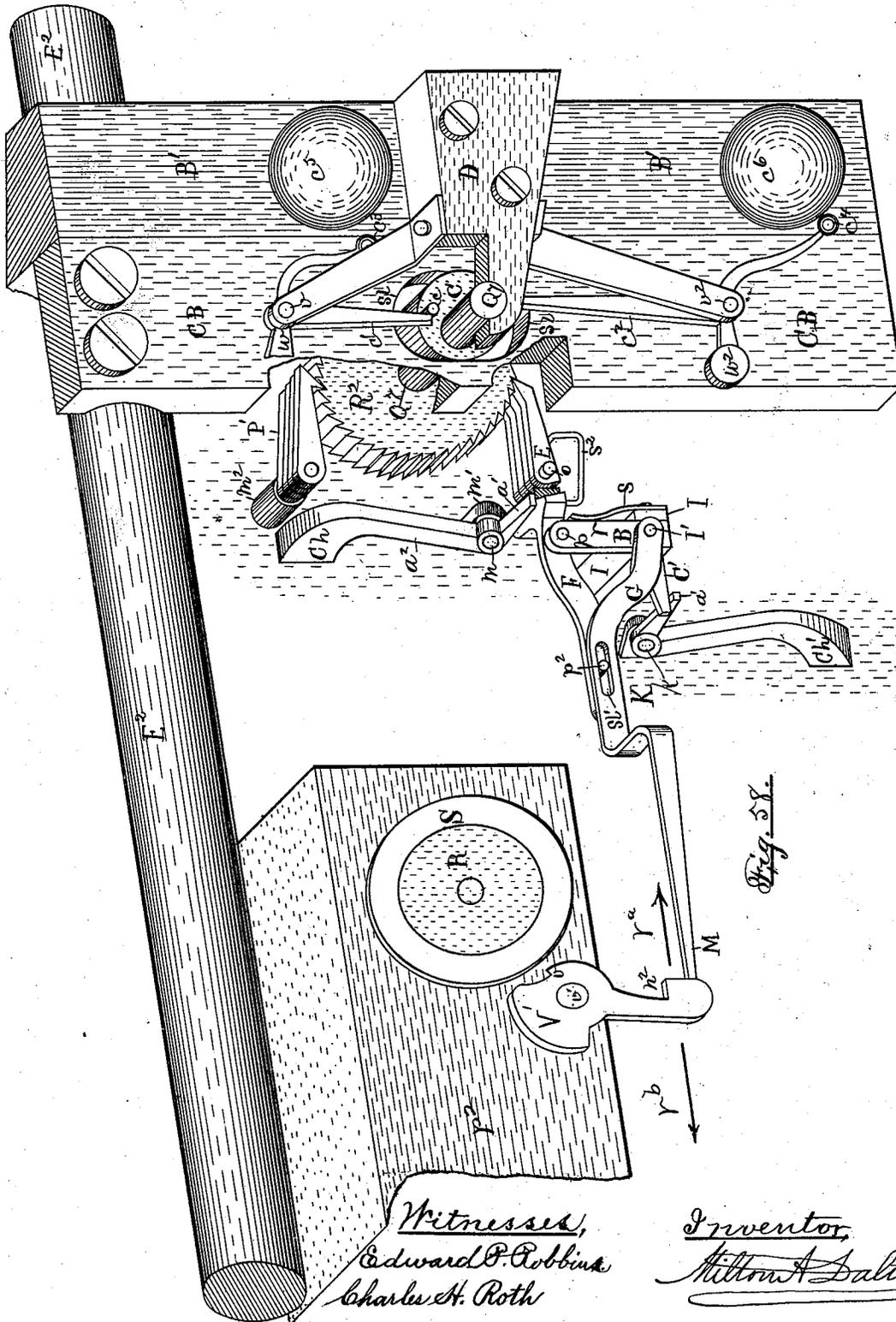


Fig. 58.

Witnesses,
 Edward P. Robbins
 Charles H. Roth

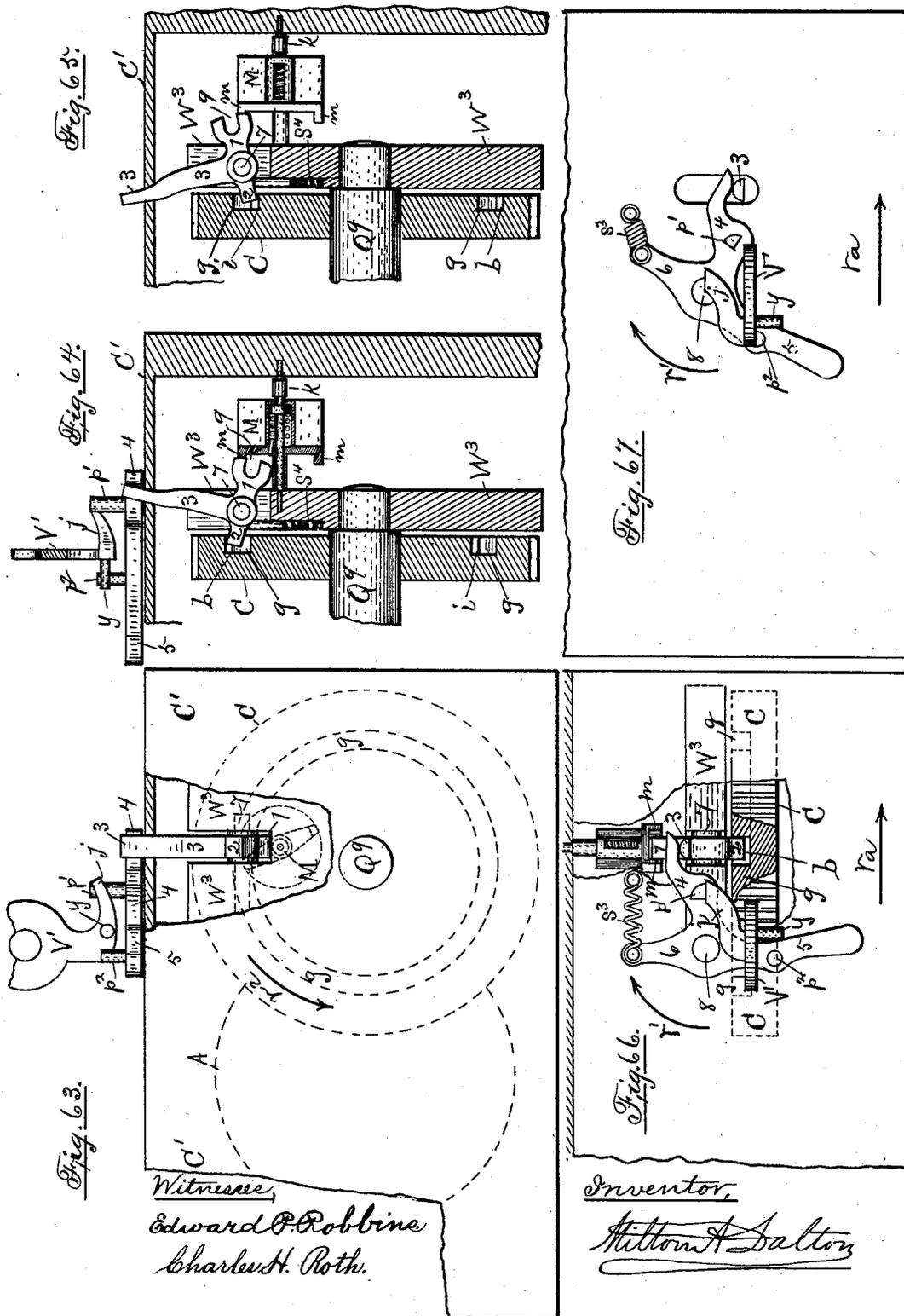
Inventor,
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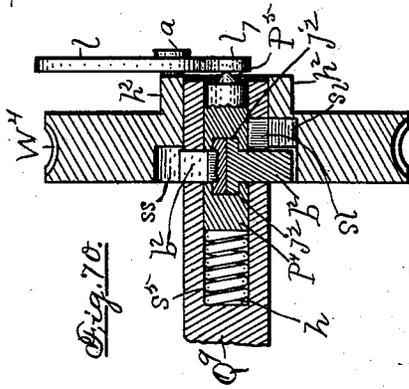


Fig. 70.

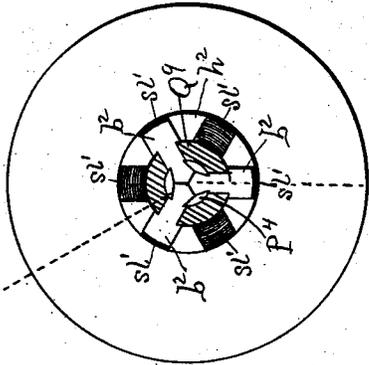


Fig. 69.

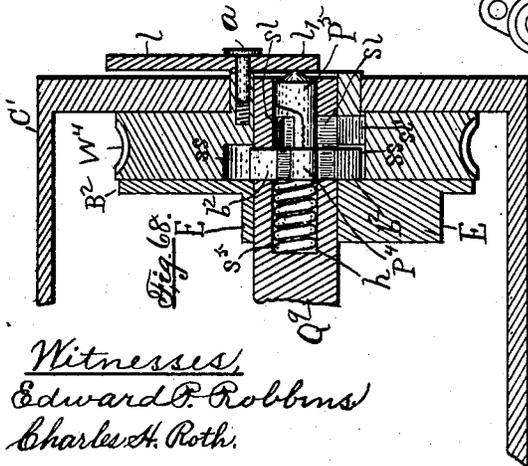


Fig. 68.

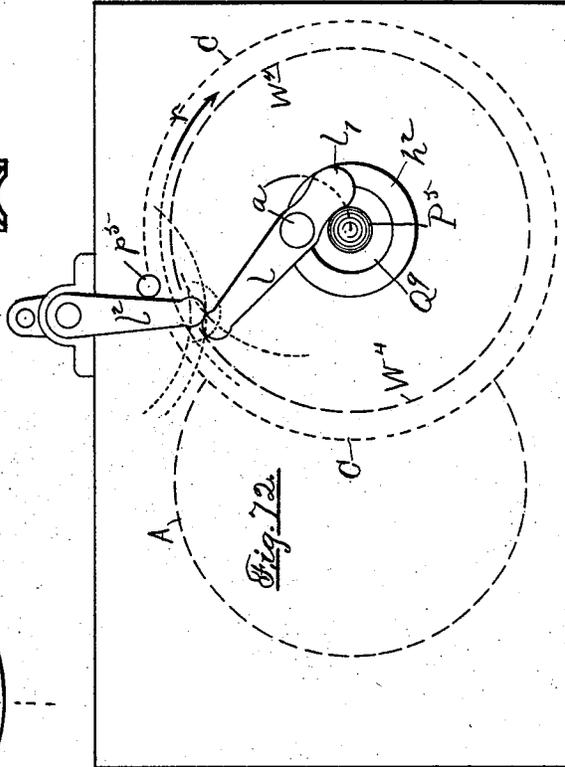


Fig. 72.

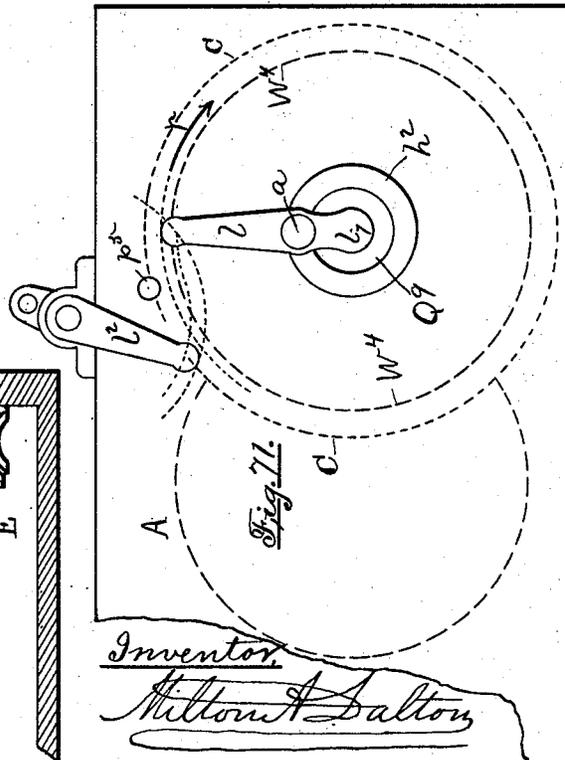


Fig. 71.

Witnesses,
 Edward P. Robbins
 Charles H. Roth.

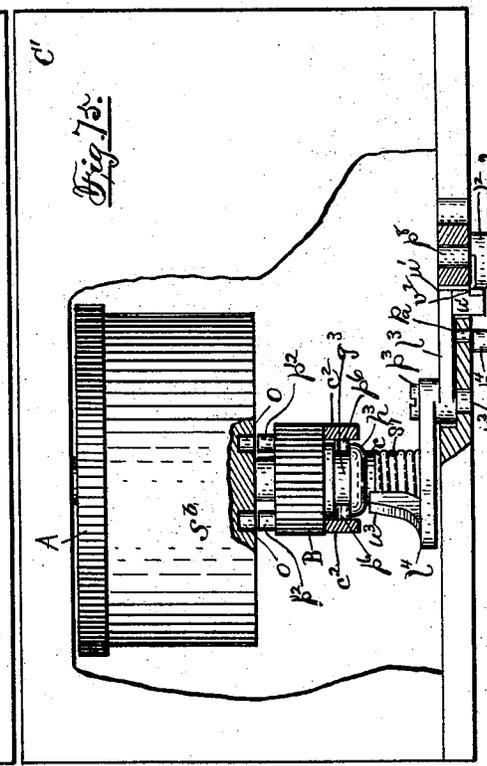
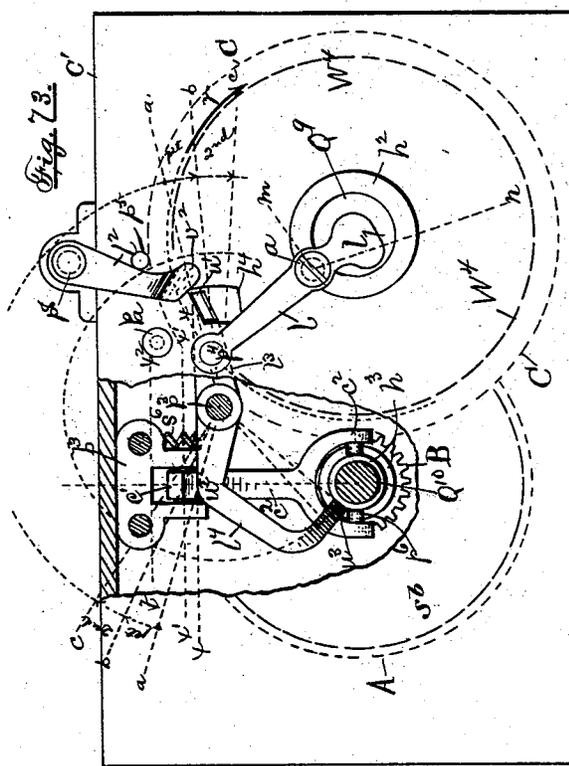
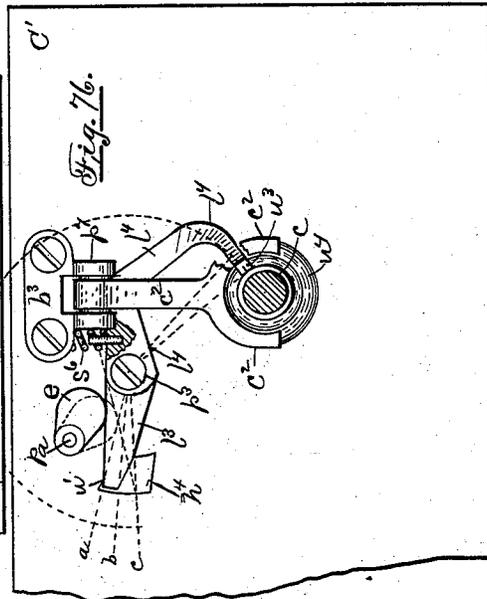
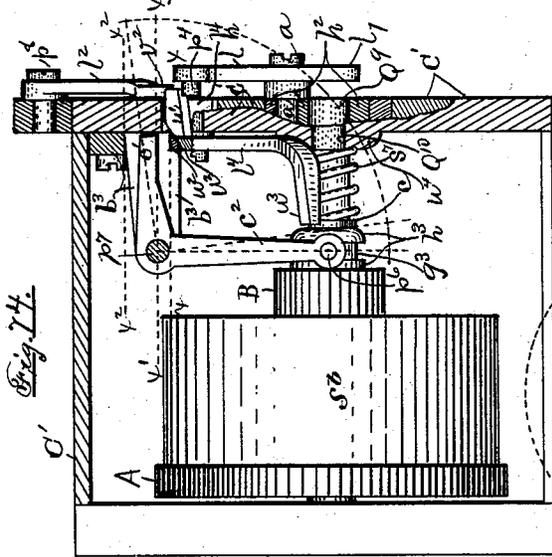
Inventor,
 Milton A. Dalton

M. A. DALTON.

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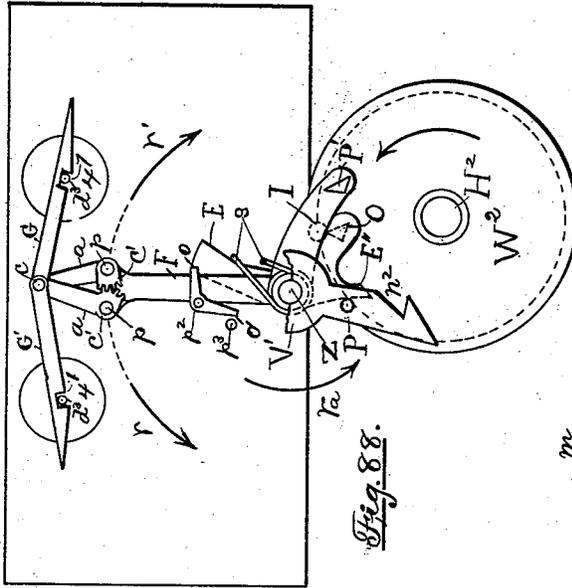


Fig. 88.

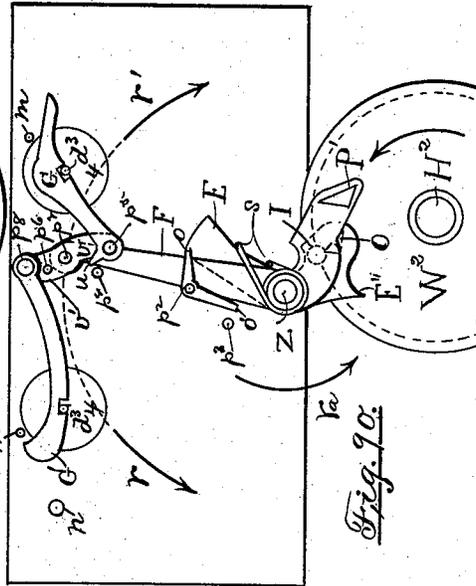


Fig. 90.

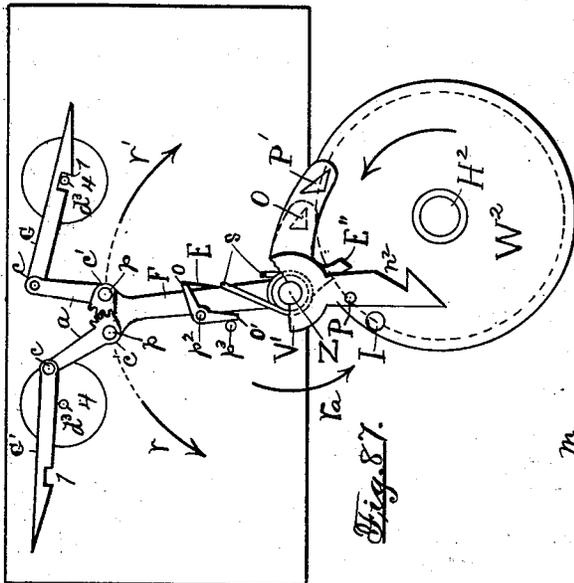


Fig. 87.

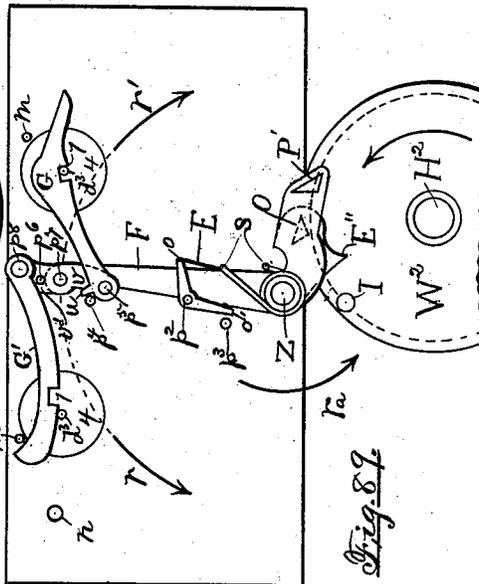


Fig. 89.

Witnesses,
Edward P. Robbins
Charles H. Roth.

Inventor,
Milton A. Dalton

UNITED STATES PATENT OFFICE.

MILTON A. DALTON, OF CINCINNATI, OHIO.

METHOD OF AND APPARATUS FOR CONTROLLING AND UTILIZING CONCUSSION AND APPLYING IT TO SAFE-LOCKS.

SPECIFICATION forming part of Letters Patent No. 508,902, dated November 14, 1893.

Application filed July 14, 1888. Serial No. 279,996. (No model.)

To all whom it may concern:

Be it known that I, MILTON A. DALTON, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have discovered and invented certain new and useful Means for and Modes of Controlling and Utilizing Concussion; and I do declare the following to be a full, clear, and exact description of the discovery and invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to controlling and utilizing concussion, and particularly to controlling the force of concussion when applied to the elementary machines, or "mechanical powers," as means for moving, or operating them for the purpose of moving or operating, primary devices of which they are primary components; and, further, to the construction, arrangement, and modes of operation, and the control of the said primary devices controlled, moved, or operated by concussion; and further, to the use and the combination with these primary devices of other devices, such as locks, safe-bolt-work, or other mechanical devices, whether automatic, partially automatic, or nonautomatic, and where the control and use of the force of concussion is general in its application to mechanical devices, and as is sufficiently illustrated in this application.

Figures 1 to 5 are intended to illustrate the elementary nature of the discovery and invention and will be described first, and apart from the other figures and the remaining description which pertain particularly to the practical applications of the invention to known devices, in a special preamble in order that a clear conception of the scope of the discovery and invention may be presented.

In Fig. 1, ab is a bar resting upon supports c , and d is a block resting upon another support c and in contact with the end of the bar ab . If a blow be imparted to the end a of the bar by means of a hammer and in the direction of its length, as indicated by the arrow r , it is well known that the concussion

force will be transmitted through the bar from the end a to the end b and that the block d will be knocked away from the end of the bar ab by means of this force, or by the effect of the blow which is produced at the end b .

The above is but one of a number of familiar illustrations of the action of the force of concussion when imparted by external means to one body which is in mechanical contact with another body, or which is in mechanical contact with one of a number of bodies in mechanical contact, as billiard balls for instance.

Previous to my invention, concussion has been utilized in the industrial arts through the agency of simple tools, as where a solid body is held against a nail head and is struck with a hammer, instead of striking the nail. One of the most common acts of the artisan is to hammer upon a tool which conveys the force of his blows to the operating part of the tool or to an operating tool and these blows are administered in every direction and upon all manner of devices. The mechanic places a block against a part of a wheel or an eccentric and strikes the block with a hammer to turn the wheel or the eccentric about its shaft, but his object is simply to loosen or adjust the wheel or eccentric upon its shaft. Nevertheless, previous to my invention concussion was never used as an agency, or prime mover, to methodically move or operate, or control, mechanism or apparatus.

In Fig. 2, d is a notched wheel mounted upon a support c and ab is a bar which may rest at an angle upon rollers, as f , or simply supports, as c and E is a partition against which the bar rests. A tooth t at the end b of the bar engages the notches of the wheel when the bar ab is moved in the direction of the arrow R' . Now if a blow be struck upon the partition E at x with a hammer in the direction of the arrow r then the force of the concussion produced by the blow will be transmitted through the partition and be imparted to the bar ab and if the force is sufficient it will cause the bar ab to bound away from the partition, when the tooth t will rotate the wheel d one notch, say. If friction or other means prevent the wheel d from turning when the bar ab slides back against the

partition then repeated blows at xy will cause complete rotations of the notched wheel d .

In Fig. 3, the bar ab is placed horizontally and is suitably supported by one or more posts c , or by posts c and the spur wheel d . A spring g engaging the pin o in the bar ab presses the latter against the partition e . A rack s on the bar ab engages the teeth of the wheel d . Now if a blow be struck upon the partition e at x in the direction of the arrow r then the force of concussion produced thereby will be transferred through the partition and bounce the bar ab away, as before, and cause the rack s to turn the wheel d . The spring g will push the bar ab back against the partition as soon as the effect of the blow ceases, and an oscillating motion will result.

In Fig. 1, the force of concussion may be transmitted from a to b and move the block d without the bar ab itself being moved, or the bar may move when struck, but the bar can move in a right line only.

In Figs. 2 and 3, the wheels d could not turn unless the bar ab moved under the force of the blow. Here, the bar ab moves in a right line, also, but its action is transmitted to a rotating or oscillating body from which rotary, oscillating, or reciprocating motion may be transferred to other members of a device.

In Fig. 4 the parts first set in motion move in curved lines only.

In Fig. 4 l is a hammer like-body having a supporting arm m pivoted to a support c at h . The hammer l , as arranged, is held against the partition, or a door, e by the spring g . A blow given at x will cause the hammer l to bounce away from the partition or door in the arc u . An arm i projecting from the hammer hub, or its shaft h , or a wheel j on the shaft, may serve to transmit motion to other bodies or devices in straight or curved paths.

i and k may be pulleys and w a wrapping connector as a cord communicating the motion of i to k .

The force of concussion may be transmitted through a solid medium a short or a considerable distance before it is transmitted to a moving or operative device; and a device set in motion by concussion may be variously constructed or arranged to operate other devices placed near to or at a distance from it.

The elementary devices shown in Figs. 2, 3 and 4 may be variously arranged to operate apparatus or mechanism in proximity thereto.

In Fig. 5 ab is a bar of any practicable length through which it is desired to transmit an effective concussive force and may be made integral or of parts joined at their ends. Such a bar may be supported, directed, and protected in any suitable manner. One end may terminate in a room, office, or house, and the other terminate in some other similar near or remote place.

It is intended to transmit concussion

through a solid medium, as the bar ab , in Fig. 5, as far as may be practicable.

In Fig. 5, l may be the hammer of any form or arrangement of a concussion device placed in one locality, as an office (indicated by dotted lines) and the transferring medium ab may be operated upon by any suitable means, as a hammer, at the end a in another locality, as a house (indicated also by dotted lines). Such solid medium may extend in any direction, horizontal or vertical, as shown in Fig. 5 or otherwise, and may be stationary as shown in Figs. 5 and 6, or movable, as shown in Fig. 3 where the blow may be given to either the end of the bar ab or to the partition e .

The manner of using and controlling concussion above explained has peculiar value when applied to secure, release, or operate locks, safe bolt work and similar devices when these are used in connection with safes and other secure receptacles. It is in connection with such devices that I shall first develop and practice the application of the above described manner of using and controlling concussion.

The following description of the application of concussion to secure, release, and operate locks, safe bolt work, and similar devices, will fully illustrate the practical and effective manner in which I am able to control the force of concussion.

It has been shown above how concussion may be transmitted through a solid, stationary, and rigid medium, as the wall of a building, or the door or wall of a safe, or other secure receptacle, and may be imparted therefrom to a primary component of an elementary device which may be suitably combined with, connected to, or incorporated in, any operating apparatus or mechanism for performing any desired useful work; and also that the said first part which is in contact with the said door, wall, or partition, when subjected to the force of concussion received through the solid medium may be arranged to move in either a right or a curved line in bounding away from the said wall, door or partition, which provides for the communication from the said first moving part to other parts of apparatus or mechanism of any manner of mechanical movement, so that the action of the force of concussion as discovered by me, the methods of control invented by me, and the modes of its practical application devised by me, constitute all, and the only, essential primary bases of the new means herein for the first time described for performing mechanical operations by the force of concussion.

The scope of this invention will include, also: first, mechanism or apparatus moved or operated wholly by concussion; second, mechanism or apparatus moved or operated by concussion in connection with automatic devices; third, automatic devices freed for their automatic movement or action by concussion; fourth, mechanism or apparatus

moved or operated in conjunction with automatic devices freed for their automatic movement or action by concussion.

In primary devices moved or operated by concussion in the manner herein described all of the "mechanical powers" are applied as elementary constituents in some manner or other in one or other of the devices illustrating the practical application of the force of concussion to the movement or operation of mechanical devices. In secure receptacles such devices moved or operated by concussion are located and protected within the receptacle and may be entirely isolated from the exterior of such receptacle by its solid walls and doors, and in this application of the invention, then, a solid fixed medium separating the concussion device from the means which produce or originate the force of concussion is an essential and primary element. But the scope of the invention is not limited to means or structures in which a solid, rigid, stationary medium to be interposed between the point or place of application of the blow which produces the concussion and the point or place where the effect of the concussion is received upon a movable part or element of a form of a primary concussion, moved or operated apparatus or mechanism, as is the case with the devices herein set forth which are used within safes and secure receptacles.

The end of the bar *ab* in Figs. 2 and 3, or the hammer *l* in Fig. 4, may itself be struck directly by the means which are used to impart thereto the force of concussion. To do this in Figs. 2 and 3 it is only necessary to dispense with the partitions *e* and provide suitable stops for opposing the backward action of the bars *ab* while leaving their ends *a* exposed for receiving the blows of concussion. However, this arrangement of primary elements in concussion apparatus or mechanism cannot have such an extended or valuable application as when a solid, rigid, stationary medium is introduced as an element; as in the applications to safes and secure receptacles.

Figs. 6 and 7 show practical applications of the principle illustrated in Fig. 5.

In Fig. 6, A may be a prison office, C cells, P partitions, D cell doors, and *ab* may be a continuous solid medium, as an iron bar, and may have devices as lugs or branches adapted to make mechanical contact with the concussion hammer *l* which may be pivoted at points *h* in localities such that means as arms *i* may connect with the bolts or other locking devices of the doors and control and operate them. The officer in charge of the office could strike the bar *ab* at *a* and immediately release all of the prisoners in case of fire, while the device would be a positive guard over the other forms of locks used on the cell doors. Such a device would have especial value as a simple single means for positively controlling all locking devices in a building from a single office after all of the prisoners had retired, or in case of mobs, &c.

Fig. 7 shows how but one concussion device may be used and may be protected within a room, or a strong secure receptacle even, and be connected with and made to move or operate a wheel train, as H. J. K. which may have any suitable means, as springs or weights, for furnishing motive power. If the device is placed within a secure receptacle then the blows may be given at the point *x* on the exterior, or the point of applying the blow may be protected and secreted within a secure receptacle. Here, the bar *ab* is arranged to move upon rollers *f* and the bars *g* may connect with and control, and operate the usual locking devices of cell or other doors.

The arrangement shown in Fig. 7 indicates that any desired amount of power may be applied for transmitting the controlling action and power to distant points, and that such means may be used in connection with any kind of receptacles or buildings for securing them and controlling their fastenings, or even for controlling fastenings of any kind regardless of buildings or inclosures.

The application of concussion to the devices of safes and secure receptacles.—The application of my invention to the devices of safes and secure receptacles and described and illustrated in this specification and the accompanying drawings comprises the practical and minute application of minor features as well as a broad general presentation of the primary invention. I set forth means for and modes of moving or operating the devices of safes and secure receptacles directly and also indirectly by the force of concussion.

Since the transmission of motion and force within a secure inclosure is a constituent of my invention, the force of concussion received through and from the door or wall of such receptacles may be imparted to and made to move or operate a simple device, as a pin bar or bolt or other simple device which may have but a simple single function to perform as well as made to move any complicated apparatus or mechanism. The devices directly or indirectly moved or operated by the force of concussion may be either nonautomatic or automatic. The force of concussion may be imparted to a device at rest so that it may move and perform one or more simple or complex functions and then come to rest, or such device may have incorporated therewith or connected thereto means, as springs or weights, for maintaining action therein after once set in operation by the force of concussion. The force of concussion may be continuously applied in a manner adapted to maintain a device in continuous or intermittent action. It may be applied to temporarily or permanently arrest the motion or action of a device located within a secure inclosure. Devices having definite or periodic times for operation may be operated or controlled by the force of concussion. This force may be made to operate two or more devices,

suitably connected or combined in succession or periodically.

All of the various operations of starting, stopping, reversing, connecting and disconnecting apparatus and mechanism capable of being performed automatically may be accomplished by means of the force of and under the control of concussion.

Concussion controlled devices may be controlled from a distance by means of electrical apparatus and connections as well as by means of purely mechanical connections.

Since I have developed the application of concussion to the control of the locking and unlocking devices whose object is to directly or indirectly control the devices of safes and secure receptacles first, I shall, therefore set forth in this specification first the application of concussion to the control of the securing apparatus which is generally controlled by the above mentioned locking and unlocking apparatus. Hence, I shall first show and describe the application of concussion devices in combination with time locks, combination locks, and devices operated in connection therewith, and show how such devices and the apparatus or mechanism controlled thereby are positively certainly, and completely controlled by means of the force of concussion; it is to be understood that when "concussion device," "concussion devices" or primary "concussion device" is hereinafter referred to I mean a device adapted to receive the force of concussion, and to be moved thereby in a regular predetermined manner, with such connection or connections as will enable it to perform some office or function in connection with the other mechanical parts with which it is associated, and shall then show how concussion may be applied to positively, certainly, and completely control, move and operate the massive bolt-work of safes and secure receptacles; but on account of the close relation existing between the functions and connected operations of the locking devices proper and the bolt-work it will be necessary to consider each more or less in setting forth the other.

The following apparatus and mechanism will be set forth in the following order:— first, a structure termed a concussion timer and consisting of an ordinary time movement and the usual automatic mechanism connected therewith having and controlling the "hook," "dog," or "angle-bar" which connects with and controls ordinary automatic bolt-work in the well known manner, tripping apparatus arranged to connect with and operate the said hook, a spring-operated concussion controlled wheel train for operating the said tripping apparatus, a primary concussion device adapted to receive concussion from the inner surface of the door, or wall, of a safe or secure receptacle, and a speed regulator having provision for motion in but one direction; the arrangement being such that the timer controls all of the said apparatus

and mechanism when running; second, means for and modes of protecting such apparatus as just mentioned from injury and from being operated in any manner by the force of blows or explosions illegally or improperly communicated to any exterior part of the safe or receptacle; third, after-locking or subsequent-locking means and modes; fourth, the combination in the same structure or in connected structures of the concussion-timer with an ordinary combination lock and a safe door having the usual lock spindle; fifth, a secure inclosure, as a safe or secure receptacle, having a concussion timer located within the same at any suitable point other than on or about the door, as usual, of the same and a continuous communicating connected solid rigid medium, or a similar solid jointed medium for transferring the force of concussion received at any desired point to the inner surface of the inclosure or its door to the concussion apparatus of the timer; sixth, a concussion timer located as last described within a similar structure and having combined therewith electrical means as electro magnets, a circuit communicating with the exterior of the inclosure, and a circuit making or breaking device located exterior to the said inclosure, whereby the said concussion apparatus, so situated, is capable of being operated exterior to the inclosure, and at any desired distance therefrom, for the purpose of connecting or disconnecting the hook of the concussion timer with the automatic bolt work of the inclosure; seventh, a spring driven concussion controlled and operated combination lock; eighth, automatic means for producing concussion upon the exterior of a safe or secure receptacle; ninth, rewinding means; tenth, the application of concussion to the "mechanical powers," and which are used in connection with the devices of safes and secure receptacles; eleventh, setting the tumblers of combination locks directly by means of primary concussion apparatus; twelfth, a concussion screw device combined with an ordinary time movement having and controlling the hook which connects with and controls ordinary automatic bolt work in the well known manner, and tripping apparatus; the arrangement being such that the timer controls all of the said apparatus and mechanism when running; thirteenth, concussion apparatus comprising a spring driven wheel-train for moving bolt-work into and out of the locked condition; fourteenth, concussion apparatus operated entirely by concussion for moving bolt-work directly; fifteenth, concussion apparatus operated entirely by concussion for directly moving bolt-work into and out of the locked condition; sixteenth, a concussion screw device applied directly to moving safe bolt work into and out of the locked condition; seventeenth, varieties of "notched-hooks" and tripping mechanism controlled by a timer.

The primary object in the application of

my invention, however, to means for locking and unlocking safes and other secure receptacles is to be able to construct such inclosures without any hole or opening of any kind 5 whatever through their doors or walls, and the primary means herein described adapted to this purpose consist essentially of an arrangement of apparatus or mechanism located within the safe or secure receptacle, means 10 as an automatic or nonautomatic concussion device to be used exterior to the safe or receptacle and adapted to communicate a blow to some exterior part thereof, as a knob provided for that purpose, and a continuous solid 15 communicating medium, or equivalent thereof, for transferring the force of the said blow from the exterior to the interior of the inclosure and in a manner adapted to act effectively upon and thereby move or operate the said 20 interior apparatus or mechanism and at the same time in a manner such as not to injure to any extent whatever any apparatus or mechanism located within the safe or secure receptacle. Minor objects and subsidiary 25 means pertaining to these structures and their apparatus and mechanism will plainly appear and be pointed out in the body of the specification.

Heretofore, manufacturers of safes and secure receptacles have in the main found it 30 necessary or useful to have some kind of positive connection between the outside and inside of these structures which require to be moved in some manner when being used or 35 operated in order to be able to operate locks and bolt work by which such inclosures were fastened. This condition requires holes through the doors in which to place the lock arbors and bolt-work spindles, or else some 40 electrical connection with the interior of the inclosure by which power could be transmitted from the exterior to the interior. All interested but unbiased persons consider the 45 arbors or spindles and the holes in the doors into which these arbors or spindles are placed, to be a weakness, partly because of the inability to properly temper these devices to resist the drill and the pulverizing action of repeated concussion, and partly because of the 50 difficulty of producing a free action of these spindles or arbors and at the same time properly anchoring them in their places. The indicated difficulties have occasioned the use of 55 doors on secure inclosures which have no holes through them and no arbors or spindles connected with the timer and also with outer portions of the structure, and no means by which the locks and bolts of the interior could be operated from the exterior, but dependence 60 for locking and unlocking secure inclosures, which were conditioned as here stated, was placed in the automatic action of time locks followed by the automatic action of automatic bolt work. Evidently the automatic 65 time locks and automatic bolt-work may fail to act and thereby bring about serious results; and for this reason such devices have

not been relied upon heretofore to the extent of using them only limitedly even upon safes having no holes through the doors. In the 70 case of time locks, the difficulty of their failure to perform has been cured by the well known qualities of the nonlockout timers which are at present so extensively in use, but these nonlockout timers require arbors 75 or spindles and holes through the doors of the secure inclosures. Therefore, the problem to be solved, in making this application of my invention, is to supply secure receptacles with lock and boltwork fastenings within while 80 constructing the receptacles without holes through their walls or doors to still make the automatic bolt work and automatic locks of the interior have some positive connection with the exterior, other than through the use 85 of electricity, by which the said automatic devices may be operated when their ordinary means of action have failed.

I have discovered a mode of operation and devised means for carrying the same into effect, which will solve or accomplish the above 90 problem pertaining to the apparatus and device of secure inclosures. I have discovered that the effects of concussion can be transmitted through the solid substances constituting the doors and walls of safes and secure 95 receptacles without requiring holes or arbors through them and be capable of performing useful effects upon locking and unlocking apparatus and mechanism within 100 them, and to the best of my knowledge and belief I am the first person who has ever employed concussion in connection with any of the useful functions of locks or bolt works of secure inclosures and so as to cause these 105 devices to perform their usual operations when their ordinary means have failed.

Among safe lock manufacturers concussion has been heretofore feared as a destructive 110 agent and has been looked upon as being only such an agent, and as an enemy, and has therefore been used in this connection only for indefinite, uncontrollable, or destructive 115 purposes; but I use concussion in this connection when and as I please: directing, controlling, and manipulating its effects to any desired extent and end.

It will be shown herein that in certain forms of lock apparatus or mechanism for secure inclosures I use concussion to release 120 the previously stored force of a spring, or of gravity; or to wind up devices and thus store the force of springs or gravity to a device whose force has been exhausted, by means of 125 concussion, and by subsequently releasing the force which has been thus made available by concussion utilize it for moving or operating the lock apparatus or mechanism. It will 130 also be shown that I direct the force of concussion in such devices so that it will act directly or indirectly upon the screw, the wheel, the lever, the wedge, the eccentric, or other mechanical appliances which are used for any purposes in connection with apparatus or

mechanism of secure inclosures such as require the use of power or force to effect a desired end, and I avail myself of its use in greater or less quantities and through solid substances at a time when it may be required and in the place where it is needed.

Figs. 8 to 27 show an ordinary time movement and the hook which it controls and which engages with and in turn controls automatic bolt work as shown in Fig. 26, and these figures also show what I call concussion tripping mechanism and show the latter combined with the time movement in a manner adapting it to operate the said hook in case the timer should stop or fail to perform that function and yet not be capable of performing that function when the timer is running. Figs. 27, 28 and 29 show concussive apparatus adapted to perform afterlocking. Figs. 30 and 31 show the application of an eccentric to the movement of bolt work into and out of the locked position and where the eccentric-shaft is propelled by means of a concussion wheel train located within the inclosure and also shows this train and consequently the bolt work controlled by the hook of the time movement. Figs. 32 and 33 show a time movement and where a time movement controlled concussion device, such as shown in Figs. 8 to 27, having and controlling a hook is in combination with a tumbler combination lock and with a timer controlling non-lock-out device, and with safe bolt work L. Fig. 34 shows a method of conducting the force of concussion applied to the outside of a safe door or to other part of a safe, through the door to a concussion timer and thence leading it to the Dalton concussion timer when the latter is in place on the side wall or at any other desired place inside of the safe and at any desired distance from the safe door. Fig. 34 also shows a method of retaining automatic boltwork in the locked condition by Dalton's concussion timer and when the automatic boltwork is on or about the safe door and the Dalton concussion timer is on the side wall, say, or on some other part, of the safe as described. Fig. 34 further shows the application of electricity to connecting or disconnecting the hook of the Dalton concussion timer with automatic bolt work, or to end the control of such hook when the time movement of such concussion timer has failed to perform these functions. The method illustrated shows electricity so applied as to start concussion tripping mechanism such as illustrated in Figs. 8 to 21. Figs. 35, 36, 40, 41, 42, 43, 44 and 45 show parts of my concussion combination lock and the construction and operation of the same. Fig. 45^a illustrates the manner of employing electric bells in connection with such a combination lock. Fig. 37 in connection with Fig. 44 shows the combination of my concussion combination lock with such time and concussion mechanism, as is shown in Figs. 8 to 27 and how the latter may

be controlled by the former. Fig. 38 is a detail pertaining to Figs. 8, 9, 10 and 11. Fig. 39 shows a running spring barrel, &c. Fig. 46 shows a device adapted to be attached to the exterior of a safe door and operated at the safe by hand or at a distance from the safe by means of electricity. Figs. 47 and 48 show the application of concussion-operated mechanism to the removal or withdrawal of safe bolt work. Figs. 49 and 50 show concussion operated rewinding devices. Fig. 51 shows concussion applied to setting up combination lock tumblers. Figs. 52, 53, 54, 55, 56 and 57 show a concussion screw device in combination with a time-movement and its tripping apparatus. Fig. 58 shows the application of an eccentric to the movement of bolt work into and out of the locked position and where the mechanism is operated by means of concussion and where it and consequently the bolt work is controlled by the hook of the timer. Figs. 59, 60, 61 and 62 show concussion screw devices applied directly to control and operate automatic safe bolt work. Figs. 63 to 76 show arrangements for use in connection with the last mentioned device. Figs. 77 to 80 show a modification of a fan regulated wheel-train for use with such bolt work concussion-screw devices. Fig. 81 shows a modification of tripping apparatus. Figs. 82 to 90 show other modifications of concussion tripping apparatus.

All of the figures are fully described in the body of the description.

On account of the great number of illustrations presented different letters and numbers have been used when describing modifications or dissimilar devices, but all essential parts performing the same functions in different devices or modifications are designated by the same letters or numbers so that such parts may be easily traced in the different figures even without the aid of the description and consequently no confusion of parts will arise.

In figures which show modifications of parts or devices, some portions of devices, or even entire devices, which have been previously fully shown by drawings are shown more or less incomplete, but essential parts are always shown when necessary to sufficiently set forth an operative device.

Figs. 8 to 27 represent an ordinary time movement provided with a tripping mechanism that is connected with the hook V' of the timer in such a way that this tripping mechanism can be made to act upon this hook whether the timer is running or not, but in such manner as to be ineffectual in removing the said hook from engagement with the bolt work if the timer is running. This tripping mechanism Z, E, E', F, G is generally speaking, similar in construction and operation to that used in my former non-lock-out inventions and which is acted upon by the parts of the well known and previously devised combination lock, or mechanism.

ism equivalent thereto, which is used in what is known as non-lock-out time locks. In the present case, I drop the use of the said combination lock, or mechanism similar thereto, such as has heretofore been used to act upon and start or drive the aforesaid tripping mechanism for removing the hook of the timer, and in lieu thereof I use a train of gear wheels whose motion is preferably produced by a spring and preferably regulated by a fan, and I connect this fan regulated mechanism with the aforesaid tripping mechanism so that the latter will be able to remove the hook of the timer and I place the fan regulated mechanism in connection with a concussion releasing device for releasing it and thus put it under the control of concussion. The arrangement here is such that the concussion produced by a single blow is sufficient to free the fan-regulated mechanism for action and through it entirely remove the hook of the timer, but in case the time movement is running then the latter in connection with the said tripping-mechanism will dissipate, overrule or annul the effects of a single blow and the time movement will continue to replace (indirectly by a spring, not shown but coiled about the shaft Z and acting upon the hook V' in the direction of the arrow Va) or permit the replacing of the partially removed hook before the work of removal can be renewed by the fan-regulated-mechanism; but in case the time movement is not running, then the fan-regulated-mechanism when released by concussion can go on and complete the removal of the hook of the timer and thus prevent a lock-out by the premature stoppage of the time movement. The arrangements of the mechanism may be such that an advance of the "notched hook" G one notch only will not cause an action upon the hook at all and hence when the timer is running the said fan-regulated-mechanism cannot act upon the said hook until notches 2 and 3 of the notched hook G engage and hold to the pinion shaft d^3 of the time movement. After one act of concussion releases the fan-regulated mechanism the latter will advance one step of several of which it is capable and which are needed to be taken in order to effect the removal of the hook and so continue until the hook is released and then the fan-regulated-mechanism is brought to a standstill, but may be released again by the concussion of another blow if the first blow has not removed the hook and this operation may be continued until all of the required steps for the removal of the hook have been taken. Remembering that the ordinary operations of the timer will remove the hook, it becomes plain that the action of the fan-regulated-mechanism is not required until the time movement stops prematurely. If the time movement does stop, then the fan-regulated-mechanism will remove the hook as described and consequently the device as a whole is thereby a non-lock-out time lock which performs its functions without any connections with any arbors or spindles

through the doors, or walls of secure inclosures without requiring any holes through them. If we consider that unlocking has been effected whenever the timer hook has been removed from its engagement with the bolt work mechanism (as is the case with the construction so far described) then the secure receptacle is open and may be entered by any one,—which may be an undesirable condition in case the proper person should fail to arrive at the structure at the time it has become unlocked. To provide against this condition I introduce in connection with the above structure a combination-lock which shall also have control of the bolt work and which will require a knowledge of its combination to unlock it and then it must be unlocked before the structure will be free to be opened.

In Fig. 32, essential parts of a tumbler combination lock are shown and the hook, or "angle bar" of this lock is shown as adapted to engage and be controlled by a time movement and concussion operated device similar to that shown in Figs. 8 to 27. The tumbler shaft in Fig. 32 may be operated in various ways. It may be a spindle or arbor, or may connect with a spindle or arbor passing through the door and be operated from the exterior of the door by hand in the usual manner; or it may have connected therewith and be operated by mechanism which is worked by electricity from the exterior of a receptacle not having any kind of hole through its door; or the said tumbler-shaft may be operated by concussion mechanism similar to that shown in Figs. 35 and 36.

I contemplate that in some places trade will call for the combined use of a time movement and a concussion operated non-lock-out device such as shown in Figs. 8 to 27 and in Fig. 32, with some well known reliable tumbler combination lock adapted to be opened from the exterior of a receptacle by means of a spindle or arbor in the usual manner, but where the timer will do the usual daily unlocking and the arrangement be such that the combination lock used need not be manipulated until an emergency calls for it.

In connection with Figs. 35 and 36 a concussion operated tumbler combination lock is described which may be used in connection with the time movement and concussion operated non-lock-out device described in Figs. 8 to 27 as a means for controlling the bolt-work after the hook V' controlled by the timer has been disengaged from the bolt work and when these devices are used together for controlling the bolt-work all manner of holes through the door or walls of a secure receptacle can be dispensed with. The combined time movement and concussion-operated movement for controlling the hook which guards the bolt work is shown in Figs. 8 to 19, and these figures represent in more or less detail, the time movement such as has been previously used in my "Dalton improved

dual time lock," and is therefore so well known as to not require special description here, and the figures show what I term a fan-regulated-train of gear wheels, the said train 5 being provided with other parts hereinafter described.

Fig. 12 shows the face of a dial R having a rim S with holes *h* for pins, and represents on its face a similar appearance of figures, holes, 10 and porcelain center to that of my "dual timer" now in use, but the back part of this dial is provided with a spiral groove *sg* which starts near the center and terminates near the circumference as shown in Fig. 16. This 15 dial is rotated by the time movement once in forty-eight hours and is acted upon by the lever l^2 Figs. 12 and 13 which lever is pivoted at one end to the front plate p^2 of the time movement so as to have free motion about its 20 fastening and it carries a pin *p* on its free end which works in the groove *sg* of the dial. The dial acts by its pins 1 and 2 upon the pins *u* of a day-wheel D' Figs. 12, 17 and 18 and by cams C² Fig. 27 easily attached to the 25 rim S, upon the notch *v* of the hook V' shown separate in Fig. 14. The hook V' has the usual spring (not shown) of such devices which always tends to throw it in the direc- 30 tion of the arrow *ra* and it with the day-wheel D' is placed on the stud *st*, shown separate in Fig. 15, and which is fixed in the front plate p^2 of the time movement. The hook V' and the day-wheel can move freely about the 35 stud. The day-wheel D' carries a notched wheel U and the hook V' carries a pawl *w*, Figs. 12, 13, 14, 17 and 18, which is kept in engagement with the rim of the wheel U by a spring *s*⁵ and acts upon the notch *v*⁵, Figs. 12, 17 and 18 of wheel U. The day wheel D' has 40 its rim provided with seven notches into which the pawl X enters to hold the day wheel, wherever set, through the pressure of the spring *s*, Fig. 13 which is coiled about the hub of pawl X. The parts *st*, V', D' 45 and X are shown in their relative positions in Figs. 12 and 13 while the dial RS, lever l^2 , time movement shaft Q, fixed spring barrel *sb*, and front and back movement plates p^2 and p' are also shown in Fig. 13. Fig. 16 50 shows the spiral groove *sg* in the back part of the dial *s*, while Fig. 14 shows hook V' with its pawl *w* and spring *s*⁵, and Figs. 17 and 18 show a front view and an edge view of the day wheel D'; the parts in Fig. 17 belonging to wheel U being shown dotted, and the hook V' and day wheel D' occupying the 55 same relative positions as when placed opposite in Fig. 12.

Fig. 8 is a front view and shows the main 60 wheel A of a rotating spring-barrel acting upon a train of wheels H, J, K, &c., up to a fan M, all of which has a construction like an ordinary time movement except that its speed is regulated by a fan M instead of an escape- 65 ment; portions of the wheels H, J, K being broken away to more clearly show the con-

tinuous engagement and the whole arrangement of the said train.

Fig. 8 shows the dotted position R, of the 70 time-movement dial, the notched-hook G, its rocking lever F, the two-armed lever E E'', the pin P of the hook V' seen in Figs. 12, 13, 14, 20 and 21, the eccentric pawl *d* (similar to that *d* Fig. 37), main wheel A, train wheels H, 75 J, K, &c., the fan M, lever L with its detents I I' and its upper end *e*² in engagement with the pin *p* of the train wheel K, together with a front edge view of the fan plate *o*⁵, its bridge *o*⁴ and a side view of the fan M. Observe 80 that two modifications of means are shown in Figs. 8 and 10 for operating the lever E E''.

Fig. 9 is a top view showing the notched 85 hook G, its driving lever F, the two armed lever E E'' and its shaft *z*, eccentric pawl *d*, detent lever L and detents I and I' and parts of the fan-regulated train, with the positions 85 of some of the shafts and the train.

Fig. 10 is a front view showing the dotted 90 position of the dial R, the notched hook G, its driving-rocking-lever F, the two-armed lever E E'', the pawl *d*', a two-armed lever C C', star-wheel B and main wheel A. Fig. 11 is a 95 top view of parts shown in Fig. 10.

Fig. 39 is a sectional view of the turning 95 spring-barrel *sb*, shown in Fig. 11, the star wheel B, the main wheel A, its pinion *a*, and the train wheel H. On the shaft Q' of the rotating spring-barrel *sb* of the fan-regulated 100 mechanism and in front of the main wheel A I place the star wheel B, Figs. 10 and 11, so that it will move with the wheel A in the direction 100 of the arrow *r*⁵, and in connection with this starwheel and operated by it is the two-armed lever C C', Fig. 10, fulcrumed at *e*³ and carrying the pawl *d*. 105

The train wheels H, J, K, Figs. 8 and 9, are 105 provided with side rims *o* and *o*' and the train wheel K with a pin *p*, and the rim *o* has a notch *i* and the rim *o*' a notch *i*' to receive 110 the detents I and I' of the detent lever L which is fulcrumed at I² and extends upward and inward so as to reach the pin *p* of train 110 wheel K. Now the train wheels are so geared with reference to each other that every time 115 wheel H makes three turns and brings its notch *i* under the detent I of the lever L then the notch *i*' of the wheel J and the pin *p* of the wheel K will occupy the positions shown in Fig. 8, when the detent lever L will be free to move 120 forward and cause the detents I and I' to enter the notches of H and J and the end *e*² of the lever L to intercept the pin *p* whereby the wheels H J K are stopped and held. The 125 lever L can be pressed inward by a spring (not shown) around its hub. At a suitable place between the front and back plates $p^2 p'$ I locate a rock-shaft Z, as in the rear of the 130 stud *st* Figs. 12 and 13, and which carries the two armed lever E E'', the upper arm of which is provided with ratchet-teeth and the 135 lower arm E'' is arranged to act on the pin *p* of the hook V'; see Figs. 8, 20 and 21. On

the same rock-shaft Z and moving with the two armed piece E E'' is the rocking lever F carrying the notched hook G which acts by its notches 1, 2, 3 upon the shaft d^3 of the fourth wheel of the time movement. The star-wheel B, Figs. 10 and 11, moves in the direction of the arrow r^5 and acts upon the end c of the arm C of the two-armed lever C C' causing its pawl d' to advance and engage with the ratchet teeth of the lever arm E and move it forward. The lever E carries the rocking lever F forward and the latter carries the notched-hook G until its first or end notch 1, drops over the pinion shaft d^3 of the fourth wheel of the time movement. If the shaft d^3 is moving it will cast off the notched hook G, as next described; and the latter with the lever F and the two armed lever E E'' will fall back with the pawl d' when the end c of the lever C C' recedes into the next notch of the star-wheel B.

The rocking-lever F and its spring (not shown) having the notched hook G arranged to engage the pinion shaft d^3 of any suitable "time movement" constitute essential portions of the tripping-mechanism specifically referred to in this specification.

Fig. 38 shows the principle of the action which takes place between the notched hook G and the shaft d^3 . The pull through G in the direction of the arrow $r r$ due to the said spring (not shown) on the shaft of the rocking lever F and which acts in the direction of the arrow r^9 Figs. 8 and 10, causes a normal pressure of the tooth of G in the direction of the arrow m upon the pinion shaft d^3 . If this shaft is not moving then it holds the notched-hook G securely, but if the pinion rotates in the direction of the arrow r^6 then the tangential force in the direction of the arrow $r t$, due to the friction between G and d^3 , lifts and throws off the notched hook G and permits the said spring of the rocking-lever F to pull the notch 1 away from the pinion shaft d^3 .

In the device shown in Fig. 8 the main wheel A has ninety-six teeth which act on a pinion a having twelve teeth and therefore one revolution of A gives eight revolutions of H, or one eighth of a revolution of A gives one revolution of H, but one eighth of a revolution of A corresponds with the stroke of one tooth of the star wheel B and each of its teeth advances the pawl d' one notch of the lever E, Figs. 8 and 10; hence three teeth of the star wheel B correspond with three turns of the wheel H and also with an advance of the three notches of notched hook G.

By the above explanation we see that if a force, as concussion, be caused to act downward but once upon the projecting arm e' of the lever L disengaging its upper end e^2 from the pin p of the wheel K the fan-regulated-train will be liberated and will run for three revolutions of the wheel H (after which motion will be arrested as before explained) and thereby advance the notched-hook G until the

arm E'' of the lever E E'' acts upon the pin P, Figs. 8, 20 and 21, and draws back the hook V' from its engagement with the bolt work, as shown being done in Fig. 26.

Fig. 25 is a separate view of the fan-regulator of the same size and as shown in Fig. 8, and Fig. 24 is a top view of the same.

One important element of this application of my invention is the combination with the time-movement, or other similar wheel train, of safe-locking mechanism of a regulator having continuous motion in the same direction and which will regulate the speed of the train as does a watch escapement but better and in a manner especially adapted to the peculiar conditions under which a train may be run in safe-lock mechanism, and in connection with such regulator I employ a disengaging device whereby the regulator is permitted to disconnect from the train when the latter suddenly stops, and thus avoid sudden stresses being applied to parts of the train, while the regulator may come to a standstill when its stored energy is expended, at which time it will automatically connect with the train again so as to be driven by it when the latter starts again.

In Figs. 8, 24 and 25 a fan regulator is shown in true size, and in Figs. 22 and 23 the disengaging device is shown on an enlarged scale.

In Fig. 37 a gravity governor g called a pendulum governor, is shown connected to the same shaft n^5 as in the fan M in Fig. 8. The disconnecting device shown in Figs. 22 and 23 can be used with the ball-governor also.

The above are simple and preferable kinds of such regulators for regulating time-lock wheel trains.

In Figs. 22 and 23, n^5 is the fan shaft, operated from the wheel N, Figs. 8 and 25, and is provided with a notched part o^3 , and o^6 is the fan spindle continuous with the shaft n^5 . o^7 is a sleeve carrying the fan M and having at its lower end notches z adapted to be engaged by the notches on the shaft part o^8 when the shaft drives the fan in the direction of the arrow r'' at which time the shaft n^5 stops suddenly, as when the train is stopped by engagement with the detent lever L.

To cause the mechanism above described to perform its various functions suppose you do your locking at four p. m. with a view to open the next day at eight a. m. Then wind the shaft Q' of the main wheel A as far as you can, and wind the shaft Q as far as you can, which will be until the pin p of the lever l^3 acting in the spiral groove sg in the back part of the dial R reaches the limit of the groove at the circumference of the dial. Place the dial pin No. 1 as many hours away from No. 0, Fig. 12 as indicates the time between four p. m. and eight a. m. of the next day, which is sixteen hours. Set the day wheel D' so that the pawl X enters notch 1, as in Fig. 12, and thus placed the hook V'

when sprung into its locked position, Figs. 12 and 21, will have its pawl w in the notch v^5 of the notched wheel U connected to the day wheel D' and the pin u of the day wheel which is between notches 2 and 3 will be in position to be acted upon by the dial pin No. 1. Thus positioned, the time movement will rotate the dial RS and cause dial pin No. 1 to act on the pin u of the day wheel and turn the wheel to the right and the day wheel will then act upon pawl w and carry the upper part of the hook V' to the right and its lower part to the left and away from any device with which this part may be engaged, as the lever Va of Figs. 21 and 26, thereby disconnecting the hook from whatever it has to support, or dog, or guard and thus freeing any device so guarded that may act, or can be acted upon, as may be necessary to cause unlocking of the secure receptacle. The day wheel D' when set with pawl X in notch 1 will act for any number of hours up to forty-eight according to the setting of pin No. 1 but if more than forty-eight hours is wanted, say sixty-four hours, then leave dial pin No. 1 as it is placed in hole 16 of the dial rim S and take out dial pin No. 2. Next set day wheel D' so that pawl X is in notch 2 of the day wheel. With this setting dial pin No. 1 will first come into contact with the pin between the third and fourth notches of the day wheel and do so in sixteen hours, and rotate the day wheel D' without disturbing the hook V' until the pin u between notches 2 and 3 of the day wheel is brought in place to be acted upon by the dial pins and pawl X is again in notch 1 of the day-wheel and pawl w is brought into notch v^5 of the wheel U connected to day wheel D' , the time movement continuing to run, as it may and the dial pin No. 1 will be brought around in forty-eight hours so as to act on the pin between notches 2 and 3 of the day wheel, as in the former case, and withdraw the hook V' from engagement with bolt-work mechanism as formerly. In this way the device may be set for any number of days or hours which may be desired, and will continue to lock and unlock or guard and suspend its guard as long as the time-movement continues to run. If the time movement should for any cause fail to remove the hook I then bring into action my fan-regulated mechanism such as has been heretofore described, and this is done as follows:—I strike a blow with a hammer or other instrumentality capable of giving the desired effects of concussion at some suitable place on the outside of the safe door and these effects will be communicated through the door to a concussion hammer, as Ch , Figs. 20 and 21, within, which in turn acts by its arm a' upon the lever L and moves its detents II' and upper end e^2 , Figs. 8, 20 and 21, from the notches i, i' and pin p of the wheel HJK and in the modification shown in Figs. 10 and 11 permits the spring which drives the fan-regulated train to rotate the star wheel B in the

direction of the arrow r^5 and then one of its teeth acts on the end c of the two-armed lever $C C'$ causing pawl d' to act upon the first notch of the lever $E E''$ propelling it, the rocking lever F , and the notched hook G forward until the first or end notch 1 of the hook G engages with the pinion shaft d^3 of the fourth wheel of the time movement, not then in motion, and holds while pawl d' withdraws and until star wheel B is rotated another tooth and advances notched hook G another notch and so on until the third notch of the notched hook G is brought forward and pin p of the hook V' is acted upon by the lower arm E'' of the lever $E E''$ and the hook V' is withdrawn from its guard. If the pinion shaft d^3 is in motion when the first notch of the hook G is thrown over it this rotation will cast off the hook as previously explained and shown in Fig. 38, and let it with the lever F and the lever $E E''$ be drawn back to their normal positions by the described spring (not shown but acting with the arrow r^9) as fast as the pawl d' withdraws for the purpose of acting upon the second notch of the lever E and before pawl D' can get into action with the second notch of lever E .

The wheels and pinions of the train $A H J K$ having been shown as made and used, in Fig. 8, and the same being a conspicuous portion of any figure in which it appears it is represented in subsequent figures simply by means of disks of the same size as and arranged as in Fig. 9.

In Fig. 21 a direct connection is shown between the lever L of the fan-regulated mechanism and the hook V' of the timer. There the lever L has an extension b^3 with a pin p^3 at its extremity arranged to engage the arm a^4 of the hook V' . With such a connection of the said parts, each time the timer moves the hook V' and releases the bolt work, as it is about to do in Fig. 26, the arm a^4 strikes the pin p^3 pushing up the lever b^3 , and thus automatically disengages the lever L from the train $H J K$ and permits the latter to operate once, the object of which is to keep the fan-regulated train and connected parts in good running order by daily use. However, it is not thought necessary to operate the concussion and fan-regulated mechanism so often, nor desirable so to do on account of causing unnecessary wear of parts. For this reason provision is made for starting the fan-regulated mechanism by hand when desirable. Figs. 12 and 9 show such an attachment in combination with the concussion mechanism, and Fig. 19 shows the attachment separate. It consists of an arm or lever b pivoted at b^3 to the front movement plate p^2 and extending around the corner of the plate p^2 and having its free end b^4 resting upon the horizontal arm a' of the hammer (shown in Fig. 20) and as seen clearly in Figs. 9 and 12. The hammer arm a' being in contact with the projecting arm e' of the detent lever L a slight depression of the knob b^2 forces the projecting

end of the lever L downward and its other arm e^2 out of engagement with the fan-regulated train and permits the latter to run once.

Figs. 20 and 21 show the means which I have invented for preventing concussion when used under control as herein described from being transmitted in any manner other than through the desired concussion devices to any of the time or other mechanism of the locking devices. Fig. 4 shows in an elementary manner the same feature, where the elementary device illustrated may constitute a portion of any concussion moved or operated apparatus or mechanism. In Fig. 4 all of the parts of the devices and their supports c are isolated from the partition, door, or medium through which the concussion is transmitted with the exception of the hammer h which must make mechanical contact with the latter. The same means will be effective in preventing the force of concussion when applied blindly or maliciously, as when with the intention of damaging or displacing parts of the lock apparatus, from reaching the locking devices so that the force of blows or an explosion will be harmless to any device so protected.

In Figs. 20 and 21 the case C' which incloses supports, and protects the time movement, and concussion mechanism has flanges v^3 by which, and the screws s^2 it is secured to the inner plate P' , of the safe-door, shown in section in Fig. 20. The holes for the screws s^2 in the flanges v^3 are made larger than the diameter of the screws, as shown and elastic washers w w' as rubber, are placed over the screw bodies so as to completely isolate the flanges v^3 in every direction and on all sides from the door plate Pl ; the washers w being interposed between the flanges and the door plate Pl , and the washers w' between the flange and the metallic washers m' against which the screw heads bear and turn, and the washer w having a sleeve-like part filling the space in the eye of the flange v^3 between the metal and the screw body. When the screws are in place as in the figures they clamp the elastic washers tightly in place and secure the case C' to the door in a manner which positively prevents any concussion being transmitted to the parts of the lock mechanism other than through the concussion hammer Ch , and then effectively only when properly applied by suitable means at the knob k' in the exterior of the door and so as to travel in the direction of the dotted line and arrow shown in Fig. 20.

The principle adopted whereby concussion may be directed and controlled intelligently and effectively when applied to the locking mechanism of secure receptacles without any injury thereto is plainly illustrated in Figs. 20 and 21. Then the hammer Ch is pivoted at p^4 to the support m fastened to the casing C' and a hole n^4 permits the face of the hammer Ch to pass through the isolated case wall and rest in contact within the inner face of the inner-door-plate Pl where it is retained (no mat-

ter in what position the safe may be turned) by means of a suitable spring, as s' , which is shown fastened to the case C' and pressing against the back of the hammer arm a^2 . The horizontal hammer arm a' is shown in contact with the projecting arm of the lever L.

Referring now, to Fig. 20 it will be seen that concussion applied at K' and transmitted along the dotted line to the hammer Ch will cause the latter to bound away from the door plate Pl . But on account of the hammer being pivoted at p^4 it is compelled to move in an arc about the pivot, as explained in connection with Fig. 4, which causes its arm a' to move in another arc about this pivot and thus move the lever L of the concussion mechanism. The spring s' replaces the hammer Ch immediately, so that the combination of a pivoted hammer and a spring constitutes the preferable form of simple means whereby force transmitted through the solid material of the safe or receptacle may be received therefrom and be conveyed to and made to act upon mechanism having no other means of connection or communication with the exterior of the safe or secure receptacle.

Fig. 26 is a perspective view showing the only essential parts of the time movement and concussion-operated and fan-regulated device, described in connection with Figs. 8 to 12, which appear in the exterior of the front movement plate p^3 , and showing also essential portions of automatic safe-bolt work, and this figure shows how the hook V' of the former is connected with and made to control the action of the latter.

The parts of the bolt work shown in Fig. 26 were copied full size from a working drawing which showed the bolt work complete, but only essential portions could be included within the space specified for patent drawings.

E^2 is the upper bolt, CB the carrying bar, B' the bolt frames, C' the case within which the movement plates p' and p^3 are secured and the letters R' , w' , s^6 , and R S, U , D' , X , and V' are the same as described in connection with Figs. 8 to 21.

W is a weight which operates the bolt work when released. It is pivoted at 14 to a lever at 16 which is pivoted to the bolt frame B' at 17 and whose end 8 is supported by the hook 9 of the lever 10—13 which is pivoted at 11 to the framing or to the inner plate of the safe. The end 7 of the lever 10 is supported by the hook 6 of the dogging lever Va^4 . The latter is pivoted at 3, 2 to the inner-safe plate and the arm Va has its end n^3 shaped to engage the notch n^2 of the time hook V' . The parts are shown in the positions occupied just previous to the hook releasing the lever Va and permitting the weight 18 to act and automatically withdraw the bolts E^2 .

In existing non-lock-out devices the time in which the tripping mechanism must act to replace the partially removed hook V' which guards the bolt-work is limited by its being

necessary to effect this replacing before the main combination can be set up, and it is not practical to extend the usual work and with it the time requisite to set up the combination of the combination locks now in use; whereas, with my new mechanism, it is practical to extend the time in which the time mechanism shall act through the tripping mechanism for replacing the said hook after its partial removal. In the tripping mechanism herein described and arranged to effect a similar purpose, such limiting of the time for replacing the hook V' is not necessary because extending the time in which the time movement must trip the tripping mechanism and through it replace the hook does not extend the work of the operator, nor increase his mental efforts.

Such a device as has been described can be arranged to use up either one second or one hour before it will have accomplished the steps required for removing the hook which guards the bolt work, and as the time-movement begins at once to replace what has been begun in the work of removal it is plain that the time-movement can have any desired time to annul what has been done in the line of removing the hook before the entire removal of the same can be accomplished, because the fan-regulated mechanism which does the removing can be arranged to require as little time as we may desire in which to do its work, and as the whole operation, except the blow of concussion, where this is used to start the fan-mechanism, is automatic; it does not tax the mental powers of the operator nor increase the work he needs to do. It is seen in Figs. 12, 13 and 16 that this concussion timer is provided with what may be called a spirally grooved disk, or spiral cam, saving a spiral groove sg starting at the center and extending in a continuous spiral coil until it terminates in the solid metal at or near the circumference of the disk. By the use of this spiral groove if we wish the timer to run a fractional part of twenty-four hours we wind until the exterior termination of the groove strikes the pin p and compels the winding to stop and then the timer is prepared to run three, four, five or more days according to its capacity, and will run such a fractional part of twenty-four hours as will be determined by the operation of the day wheel in connection with such a setting of the dial pins as will measure the number of hours you desire the timer to act and as previously described. In this way we get at winding always to a fixed stop.

It is plain that I can multiply the power of the driving-spring and arrange a train to suit so as to produce a rotation of my fan-regulated mechanism which will last three or four days and in that way make a time lock which will guard the structure in lieu of the present arrangements (time movements), which use escapements.

Fig. 27 shows "after-locking" or "subse-

quent-locking" apparatus, where p^2 is the front movement plate, and RS the time dial, and V' its hook. Va is the dogging lever of the automatic-bolt-work arranged as in Fig. 26, and is here provided with a lug 6 which is shown resting upon the end of the angle-piece or trigger 7—8 pivoted at 3 to a support 10. A concussion hammer Ch pivoted at 4 to a support 15 has its face in contact with the door P' and its projecting arm a' in contact with the arm 8 of the angle-piece or trigger 7—8. When the said parts are in this position the lever Va holds the bolt-work locked, as shown in Fig. 26, and the arm 7 of the angle-piece or trigger 7—8 holds the lever Va in position to engage with the notch n^2 of the timer hook V' whenever the latter is permitted to move in the direction of the arrow ra . 16, 17, 18 is a lever pivoted at 1 to a support 13 so that its weighted end 18 tends to hold the end 16 up. The end 16 has a hook h' adapted to engage a projection n^3 on the end of the timer hook V' , and when connected with it will hold the latter out of engagement with the bolt-work lever Va . A concussion hammer Ch' is pivoted at 2 to a support 14 with its face in contact with the door-plate P' , and its projecting arm a' in engagement with the under side of the end 17 of the lever 16—17.

When the safe door is closed and the devices are arranged as in Fig. 27 provision is had for after-locking. To do this, concussion is first applied to the hammer Ch' which disengages the hook h' from the hook V' and permits the latter to move in the direction of the arrow va and have its notch n^2 engage the end n^3 of the bolt-work lever Va . If then concussion be applied to the hammer Ch it will trip the trigger 7—8 and the lever Va and place the latter under the control of the hook V' of the timer. By combining a concussion device, such as shown and described in connection with Fig. 46, with the hammer Ch and Ch' in Fig. 27, after-locking may be accomplished at a distant point at any desired time. The hook V' may be held out of engagement with the lever Va by means of cams C^2 attached to the rim S of the dial R. The cam C^2 is secured to the rim by means of a pin, as l , and its periphery coincides with and moves in the arc r, b, a , so that the cam will make contact with the projection at v of the hook V' and force the hook, into the unlocked position and away from the lever Va and keep it in that position until the cam has passed by the projection at v . When the length of the surface of the cam c^2 which comes in contact with the hook V' determines the length of time during which the hook will be off guard and it is plain to see how cams similar to C^2 may be placed around the rim of the dial and act to remove the hook V' out of, and replace it in, the guarding position as and when desired. When using such cams as C^2 in connection with the lever Va and concussion hammer Ch it becomes necessary

each morning (after the time movement has acted upon the hook V' and effected its removal) to strike a blow at the proper point on the outside of the safe so that the blow will act upon the concussion hammer Ch and cause the latter to act upon the arm 8 of the angle-piece 7—8 and disengage the latter from the lever Va of the automatic bolt work to permit it to automatically unlock. When the cams C^2 are not used and only the functions of my non-lock-out concussion time-lock, as shown in Figs. 8 to 27, are needed then the angle-piece 7—8 may be dispensed with.

Fig. 28 is a side view and Fig. 29 an end view showing another modification of means for after-locking and where the timer automatically trips the lever 7, as well as controls the timer hook V' . Here the end n^{13} of the lever Va is supported by the upright trigger arm 7 pivoted at 3 at an incline to the vertical line $x-x$ so that a slight force applied at its upper end will push it in the direction of the arrow r and from under the lever Va . The pivot 3 is secured to the support 10. The parts are so arranged as plainly seen in Fig. 28 that the notch projection z of the timer hook V' will pass under the end n^{13} of the lever Va before it comes in contact with the trigger 7, but that it will then strike the latter and push it in the direction of the arrow r during the remainder of the motion of the hook V' in the direction of the arrow Va and as the parts can be so adjusted that the weight of the lever end n^{13} will be transferred to the projection z of the hook V' it is plain that the said projection will trip the trigger 7 which will turn on its pivot and hang from it out of the way of the lever Va when it is subsequently released by the hook V' and falls. It is plain that if a pin in trigger 7 extended forward and an arm be attached to the dial S the arm could be arranged to strike this pin and thus trip the trigger 7. The trigger arrangement shown in Figs. 28 and 29 can be used in connection with the timer when its hook V' is held off guard by the concussion tripping device 16, 17, Ch' , &c., in which case it will replace the concussion tripping arrangement 7—8 and $a' Ch$; or the said device can be used in connection with the timer when its hook V' is held off guard by means of cams C^2 attached to the rim S of the dial R , in which case both concussion hammers, Ch and Ch' and the apparatus connected therewith would be dispensed with; and in each case mentioned the timer hook V' would itself trip the trigger 7 Fig. 28 and then there would be no occasion to operate such tripping mechanism in the morning when unlocking, as when the hammer Ch and the trigger 7—8 are used. Some users of such locking devices may desire to have the bolt work guarded by both a timer and a combination lock and have the timer guard the combination lock but release its guard on the combination lock so that the latter can have its combination set up and the structure then

unlocked at a fixed hour; and yet, in case it should not, on special occasions, be desirable to unlock by the combination lock, or in case the combinations when tried by setting them up should fail to unlock, have the devices capable of unlocking automatically at a subsequent hour.

Fig. 32 shows a method of combining a Dalton concussion timer with a combination lock and safe bolt work when the last two devices are of the ordinary kind and such as are generally used upon safes and other secure receptacles which have lock arbors and bolt-work spindles and where the doors of the said structure have the usual holes through them which are filled by the said arbors or spindles. As arranged in Fig. 32 all that is above suggested or desired can be accomplished. No concussion device is shown here for want of space but a fan-regulated-train, &c., as described is to be located within the case C' as in other cases.

Fig. 32 shows a safe bolt E^2 with a carrying bar CB to which latter is attached an upright lever $l^4 l^5$ and at the upper end of the lever $l^4 l^5$ is attached at p^5 a projecting link k so made and pivoted that on closing the safe door a projection m of the said lever strikes the frame-bar B' and causes the other end k' of the lever k to rise and lift the dog ij into position when the automatic spring tripping-mechanism on the end of the timer case C' comes into play and places a projection l^6 (on the upper end of the dotted-in arm g^2 which turns with the shaft g and which is in the rear of the projecting frame part F') under the end of the dog i and thereby prevents its falling until removed by the timer. Fig. 32 shows also connected with the lower end l^5 of the lever $l^4 l^5$ another lever k^2 having a projection m' which strikes the frame bar B' when the safe bolt work is shot into the locked position and which projection m' causes the outer end n of the said lever k^2 to rise and bring a spring acting hook o into connection with a lug b' on the bolt B^3 of the combination lock where the said lever k^2 will be held until the bolt of the combination lock is removed. The lever $l^4 l^5$ attached to the carrying bar CB at g has its upper end l^4 fixed at the point p^5 when unlocking is to be effected by the combination lock; and the lower end l^5 is held fixed when unlocking is to be effected by the timer. The dog ij is fastened to the safe door at p^4 and is connected by a pin p^7 with the end k' of the lever k which is pivoted to the upper end of the lever $l^4 l^5$ and the pin p^7 slides in a slot $s s$ in the dog ij when the safe bolt work is withdrawn or unlocked. The lugs $l^3 l^9$ project from the door plate and act on the ends of the levers k and k^2 when the latter are in the positions shown and sustain any back pressure of the bolt-work and prevent this pressure getting to the combination lock or the timer. The spring-hook o is pivoted at 10 to the end n of the lever k^2 and held in place by the spring s^3

and the pin P^{11} and enables the combination lock bolt B^3 to be shot or locked before the safe door is closed.

b is an angle-piece pivoted to the pin or pivot v' of the timer hook V' and is kept in engagement with pin b^3 by the weight of its counterpoise w^3 . The object of this arrangement of the angle-piece b is to enable the cam C^2 on dial rim S to act upon the hook V' and remove it when the dial R moves in the direction of the arrow r^8 and yet when winding the dial R , or moving it in an opposite direction, to let the cam C^2 pass the angle-piece b without disturbing the hook V' . The angle piece b is so arranged that its operating end projects in the line joining the center of the dial R with the center of the pivot v' of the hook V' and so that the cam C^2 will strike the end of the piece b and cause it to rotate the hook V' and disengage it from the lug a^5 on the angle-bar a^6 of the combination lock. The arrangement is such as to have the periphery of the cam C^2 act on the end of the arm b and hold the hook V' out of engagement with the lug a^5 on the angle-bar a^6 a time corresponding to the acting surface of the cam C^2 . This device and arrangement permit of winding and rewinding without removing the cam C^2 .

The mechanism arranged upon and adjacent to the frame piece F' at the end of the timer case C' in Fig. 32, constitutes a non-lock-out device, and no claim is herein made thereto except when used in combination with such other mechanism as shown connected therewith in Fig. 32.

F' is a frame-piece attached to the case C' and supports the bearings for the attached mechanism. It extends into the case C' at its lower end and there has a lug z^4 . An arm z' on the shaft g has pivoted thereto at g' the piece w whose end w' is adapted to catch behind and press against the lug z^4 at F' . The upper-end of the piece w carries a pin p^3 . The lever f partly broken away, is attached to a shaft z^5 and a spring (not shown) impels it in the direction of the arrow i^3 . The crank c^4 is pivoted in the rear of c^2 , c^2 being its axis.

c^3 is a semicircular pin or lug projecting in front of the crank c^4 .

On the back side of the upper end of the lever f is a lug l^{10} , (shown dotted in) and the arrangement of the parts is such that when the rod d^2 which connects with crank c^4 at p is pulled inward the lug c^3 turns about c^2 and permits the lower end of the lug l^{10} on f to trip over it in the direction of the arrow i^4 when the spring on shaft z^5 forces the end f' of the lever f in the direction of the arrow i^3 and in contact with the pin p^3 on the piece w and carries the latter against the boss z^3 of the lever z' and raises w' free of the lug z^4 and then causes both w and z' to rotate in the direction of the arrow i^2 about the axis of the shaft g . As shaft g rotates it moves the arm g^2 (shown dotted-in at the rear of the

piece F') outward until its lug l^{11} moves from under the dog ij and permits the latter to drop.

Fig. 33 is a top view of the parts j , i and l^{11} showing the lug l^{11} moved from under the dog i , which is in section. It is seen that the day wheel D'' carries a pin p^{13} between the notches 1 and 2, and the dial rim S carries in connection with the cam C^2 the pin 1. The latter is placed in this instance sixteen hours from the place it is to engage with the arm b of the hook V' which is connected to the day wheel D' and when the pin 1 engages the day wheel, as described in connection with Figs. 12, 13, 14 and 17, the cam C^2 engages with the angle-piece b of the hook V' and the day wheel D' moves until its pin p^{13} comes into contact with the lever c and moves the rod d^2 which pulls the crank c^4 and trips the device at the end of the timer case C' and drops the dog ij to the arrow Va until it clears the lug or At the same time the hook V' moves contrary stump a^5 on the angle bar a^6 of the combination lock. At this time the combination lock may be manipulated and unlocking should be effected, but if unlocking can not then be effected by the combination lock the dial pin 2 which is twenty-four hours away from pin 1 and cam c^2 (being at the start forty hours from the point at which it will come into contact with the day wheel) will in twenty-four hours move the day wheel D' and cause pin p^{13} to act on lever c and through the rod d^2 and the other described parts move the (dotted) arm g^2 and free the dog ij and permit the lever k to drop and thus bring about unlocking automatically by the timer. The lever k must have room to move inward as shown by the centers and dotted radii and arcs, before it can drop. If the time movement stops then concussion may be employed to release the guard of the timer over the combination lock but it will not release the guard of either the timer or the combination lock over the safe-bolt-work. Therefore, to unlock the bolt-work when the timer stops prematurely, or is stopped, it would be requisite to first apply concussion to the fan-regulated mechanism and enable it to remove the hook V' from engagement with the stump a^5 of the angle-bar a^6 of the combination lock and then set up the combination of the combination lock, and if such could not be done if the banker did not have it it is plain that as burglars under such circumstances could not obtain the combination from him they could not effect an entrance even if they could succeed in stopping the motion of the timer. The combination can be kept safely by parties at a distance and can be obtained by telegraph in case of necessity, as in the case supposed.

For every day use, however, this device may be set so that the timer will automatically unlock in the manner described, and thus there will be no need to daily use the combination

lock. Yet, when the timer prematurely stops the combination must be used before unlocking can be effected.

Many variations of the construction and management of such locking devices by those skilled in the various uses to which time and the previously known combination locks are put can be made without further invention by simply differently arranging the mechanical devices and the parts shown in the annexed drawings.

In order to have the timer automatically remove the hook V' and hold it out of engagement with the lug a^5 on the angle-bar a^6 of the combination lock a sufficient time to permit the combination of the latter to be set up and this lock unlocked, and the bolt-work withdrawn, arrange the cam C^2 , Fig. 32, to act upon the angle-piece b and withdraw and hold the hook V' at some fixed hour and continue its action during the time the cam is in engagement with the hook V' and cease to hold this hook as soon as the cam moves on and out of engagement with the hook. While the cam is engaged with the hook unlocking may be effected by simply setting up the combination of the combination lock and withdrawing the bolt B^3 in the usual manner and then withdrawing the safe bolt-work in the usual manner by the handle arbors. If, however, this unlocking is not produced or cannot be produced by such setting up of the combination lock at the time stated then the pin 2 in dial rim S will come around and act upon the day wheel D' and through its pin p^{13} act upon the lever $C C'$ whose arm c' acts upon the connecting rod d^2 which connects at p to the spring-driven lever e^4 that trips the trigger lever f which latter moves the spring-held piece w by its pin p^3 about the pivot g' when the shaft g will remove the support l^1 that holds the compound dog ij and permit it to fall and allow the bolt-work to be withdrawn. See the description of Fig. 34 in the brief of figures. Suppose in case first that concussion is applied at K' in Fig. 34. Its effects will follow the dotted line to the center of the face of the concussion hammer Ch thence by hammer arm a^2 , and connecting link $F F'$ to the lever G^4 pivoted at p^2 to the safe wall, which lever acts upon the projecting end L^2 of the fan regulated-mechanism lever L so as to disengage it and permit it to move the hook V' in case the time movement of the Dalton concussion timer has been prematurely stopped. The wire spring s^3 keeps the hammer Ch in contact with the inner face of the door plate Pl so that there is a positive continuous mechanical connection leading from the safe door to the distant concussion timer by which the force of concussion may be transmitted effectively. Suppose in case second that we desire to have the connecting lever Va of the automatic bolt-work so retained as to be subject to disengagement by the Dalton concussion timer and when the latter is located at a distance from the safe door. We

will then cause the free end n^{13} of the lever Va to rest within the notch n^2 of the hook h , which is pivoted at p^3 to a frame piece B^2 attached as s' to the jamb $a a$, and this hook h is connected by the link X , angle piece $Y Y'$, and link $z z'$ to the hook V' of the Dalton concussion timer. The angle-piece $Y Y'$ is pivoted at p^4 to a frame-piece C^2 located in the corner of the safe. A bent lever $A' A^4$ is pivoted to the screw-pin c' whose screw s is screwed into the side of the bolt-frame B' and has a lug l' at its lower end to engage the pin p' projecting from the side of the bolt-frame. The spring s^3 is attached to pin c' and to the lever $A' A^4$ at w^3 and tends to direct the end A^4 inward, the pin p' and lug l' serving to stop the arm $A' A^4$ in the position shown. Suppose the lever Va of the automatic bolt-work is supported by the bent lever $A' A^4$ and the safe door is open and that we now close the door. The door P', P^3, P^3, P^4 is shown partially closed at o, o, o ; the bent arm A^4 is shown pressed into its notch n in the edge of the jamb $a a$ so that as the door is further closed the end A^4 will be held stationary and thus its supporting corner b will be drawn from under the edge of the bolt-work lever Va . In the position shown, the free end n^{13} of the lever Va has moved partially into the notch n^2 of the hook h and the bent lever $A' A^4$ is partly withdrawn from under the lever Va . When the door is pushed shut the corner b of the bent lever is drawn clear of the bolt work lever Va , when the latter drops into and is supported by the notch n^2 of the hook h , and thus the bolt-work is at the same time automatically locked and automatically connected with the hook V' controlled by the time movement; and it is seen that the bolt-work after being locked remains under the control of the time movement. It is plain to see that the movement of the hook V' by the timer contrary to the direction of the arrow va will draw the notch n^2 of the hook h free of the end n^{13} of the bolt-work lever Va and drop the latter, whereby the bolt-work will be free to automatically unlock by the action of a weight, as shown clearly in Fig. 26.

In case third, Fig. 34, I connect the electromagnetic apparatus $P P, R R$ and $w' w^2$ by the angle-piece ON pivoted at p' and the connecting link M with the lever L of the concussion mechanism. Whenever the armature $P P$ is drawn toward the coils $R R$ it carries with it the arm O of the angle-piece ON causing the arm N to pull the link M when the latter acts on the lever L so as to disengage the fan-regulated mechanism, previously described, when the latter will release the hook V' in case the time movement of the concussion timer is not running, and in that way electricity may be made to operate the concussion mechanism of a concussion timer.

Fig. 34 shows the position of the various parts of the mechanism employed as well as the relation to each other, to the safe door, jamb, safe bolt-work and the safe walls, and

shows how the wires w' w^2 are led out to where they may be connected with any suitable battery and circuit closer located at any desired near or remote place.

5 It is plain to see that if an electro-magnet, as R R, be placed on its side in the corner of the safe in about the position of the bell crank Y Y' so that the base piece B² could be secured to the jamb a , and the pivot p^7 of
10 the electro-magnet arm N could come where the pin p^4 is, and with the magnets R R between the pivot p^7 and the hook h , and the connecting-rod M be turned about the pin p^6 and made to extend in the same direction as,
15 and made to replace the connecting rod X, connecting arm Y with the hook h , that then were the armature P P attracted the connecting rod M would push the hook h under and into engagement with the end n^{13} of the
20 bolt-work lever Va. The latter arrangement would enable afterlocking to be performed by means of electricity, and when the electrical apparatus was manipulated at any desired place. It is also seen that the two arrange-
25 ments of electro-magnetic apparatus described may be connected with the hook h at the same time; the first being used to unlock and the other to perform "subsequent locking."

30 *The concussion combination-lock.*—I make a concussion combination lock by employing two spring driven shafts and causing each to act upon the same fan-regulated mechanism, such as shown in Figs. 35 and 36, and provide
35 these shafts and their connections with any well known means which permits one of them to be in action while the other stands still. Connected independently of each other with these spring-driven shafts are the two notched
40 tumblers and they are so constructed, arranged and prepared relative to each other that the signal pin which either carries will act upon its own independent bell and through
45 a tumbler as the tumbler turns when being moved to its unlocked position. To cause the mechanism to operate as desired, I arrange the spring driven shafts so that they will proceed a known or fixed distance after these
50 devices have been released by concussion releasing mechanism and then be stopped until again released, and so on thus permitting them to move any desired distance. Through such mechanical appliances I am able to determine
55 by the bell some known position of the tumbler and thereafter rotate it until any desired point of its circumference (say its notch) is brought into position for unlocking, and there it will stand until a second tumbler is similarly brought to its unlocking position. Such a concussion combination-lock may be made to act alone upon safe bolt work, or upon a time movement, or other devices; or it may be otherwise combined with
60 time movements so as to prohibit their effects upon the bolt work or permit them as the case may require.

Figs. 35, 36, 37, 39, 40, 41, 42, 43, 44 and 45 show how a concussion combination-lock is constructed, how a concussion device may act
70 directly upon and control safe bolt-work, how the said lock and bolt work may be combined with a time movement and a fan (or governor) regulated device, and how such devices act when the force of concussion is transmitted
75 through springs, or when it proceeds directly, to operate combination lock tumblers.

Fig. 35 is a plan view showing a section of a safe door P', &c., (which is made without any hole through it) and to which a spring-
80 operated concussion combination-lock is attached; parts being in section along the line $x''-x''$, Fig. 36. On account of several wheels being placed on the same shafts in this lock it was necessary to break portions of certain
85 wheels away that more or less of the other wheels farther back could be shown and all of the parts of the lock be shown in their relative positions in one structure in Figs. 35 and 36. Fig. 36 is a front view showing the
90 said parts broken away. Fig. 39 is shown in this connection to show that a shaft Q' and a turning spring-barrel sb , such as shown and used in Fig. 11 could be used in a concussion combination-lock instead of shaft Q³ and its
95 fixed spring barrel. Fig. 40 is a rear view of the ratchet and pawl on shaft Q³ (not shown in Figs. 35 and 36) which enables shaft Q³ to drive wheels B', B⁴, and C which are loose on shaft Q³. Fig. 41 is a top sectional view
100 showing the main or spring-driven shaft Q³ in the left portion of the lock, and its stationary spring-barrel, and the parts carried by the shaft Q³. Fig. 42 is an end view of the tumbler shaft H' and the disks d^5 . Fig. 43 is
105 a plan view of the tumbler shaft and a sectional view of the tumblers and the wheels on shaft H'. Fig. 44 shows portions of the mechanism of the left portion of the lock. Fig. 45 opposite Fig. 44, is an end view of
110 nearly all of the left portions of the lock and the parts belonging to the tumbler shaft H'. For simplicity in explaining Fig. 41, the wheels B', B⁴ and C are shown integral with a common sleeve s^6 , but in practice they are
115 separately constructed and then attached to the sleeve.

Each of the independent spring-driven devices above mentioned consists essentially of a main shaft and spring-barrel and driving-
120 spring, and a set of wheels and levers carried by the said shaft and the adjacent parallel shafts suitable ratchet and pawl devices and a concussion-hammer pivoted with its face in contact with the inner face of the safe door
125 and arranged to communicate its motion and force to the driving mechanism with which it is connected. The tumbler mechanism shown separate in Figs. 42 and 43 as well as in Figs. 35 and 36, has a stud H' (called the tumbler-
130 shaft) secured in the front movement plate F⁵, which carries the spur-wheel C³ fixed to the spur-wheel C⁴; both turning together loosely on the stud H'. This shaft also carries

the spur-wheel D' and its attached tumbler D^3 and the spur-wheel D and its attached tumbler D^2 : the wheels D and D' being opposite and separated by a disk d^3 , Figs. 42 and 43 which has a tongue l filling the slot g in the stud H' and which disk prevents one of the said wheels from moving the other when it turns. For the same reason a disk d^5 is placed between the tumbler D^3 and the wheel C^4 .

In Fig. 41 the spring-barrel sb^2 is shown secured to the back movement plate F^4 and the shaft Q^3 supported by the spring-barrel and the front movement plate F^5 . A ratchet R , Figs. 40 and 41, is secured to the shaft Q^3 by the pin z and engages the pawl p^5 and thus turns notched wheel B^6 in the direction of the arrow r^2 , Fig. 36, and since the wheels B^6 , B^4 and C are all carried by the same sleeve s^6 they are all driven together. The ratchet C drives the spur-wheel C^2 in the direction of the arrow r^2 by means of the pawl p pivoted at p^2 to the rear side of the wheel C^2 as clearly shown in Fig. 36.

Referring now to Figs. 35, 36, 44 and 45 it is seen that wheel B^4 drives the pinion B^2 carried by the parallel shaft i' which is supported by the back plate F^4 and the bracket b^4 , and the shaft i' carries the disk-wheel B having a pin p^4 , and that when B^4 rotates with the arrow v^2 , Fig. 44, the pinion B^2 and wheel B are rotated with the arrow v .

Figs. 35, 36 and 45 show a three armed lever A^4 pivoted to the shaft 4 which is supported by the movement plates F^4 F^5 . In Fig. 36 its arm i^4 is shown in contact with the projecting arm a' of the hammer Ch , which is pivoted at 1, and its arm i^6 having a pin p^7 for engaging the end i^3 of the lever A^6 which is pivoted to the shaft 6. The pendent arm of lever A^4 has a detent d^3 for engaging the pin p^4 on the wheel B and a detent d for engaging the notch n^2 of the notched wheel B^6 . A^7 is a lever similar to A^6 and pivoted to shaft 7, and the levers A^6 and A^7 connect and operate together by means of the pin dc in A^7 and slot s^{10} in A^6 and A^7 has a detent da which engages the pin p^6 on the spur-wheel C^3 . It will now be plain that if concussion

be applied at the knob K' , Fig. 35, and transmitted along the line to the hammer Ch it will force the latter from the door plate P , Fig. 45, and rotate it about the pivot 1 and thus release the end i^4 of the lever A^4 and at the same time force the detents d and d^3 out of engagement with the notch n^2 of the wheel B^6 and the pin p^4 of wheel B and depress the end i^3 of the lever A^6 and release the detent da from the pin p^6 on wheel C^3 .

Referring to Figs. 35 and 45 and particularly to Figs. 35, 41 and 43 it will be seen that wheel B^4 besides driving the pinion B^2 also drives the spur-wheel D on the stud H' and the connected tumbler D^2 . Figs. 35, 36, 41 and 43 show clearly a direct driving connection between shaft Q^3 , ratchet and pawl RP^5 , wheel B^6 , sleeve s^6 , ratchet wheel C , pawl p ,

Fig. 36, spur-wheel C^2 , spur-wheel C^4 on tumbler-stud H' , spur wheel C^5 connected to the wheel C^4 , pinion C^6 , wheel C^7 , pinion C^8 , wheel C^9 , and pinion C^{10} on the shaft of the fan 11. By following the similar parts pertaining to the similar but independent device connected to and operated by the shaft Q^4 , it will be seen that its spur wheel C^3 also engages the wheel C^4 on the stud H' and consequently can drive the same train C^5 , C^6 , C^7 , C^8 , C^9 , C^{10} , and C^{11} . It is also plainly seen that when the wheel C^2 , Fig. 36 drives the wheel C^4 in the direction of the arrow on C^4 , the similar wheel C^3 will rotate with it in the direction of the arrow r^3 , and that on account of the connection by the pawl p' with the ratchet, C' the main parts of the device connected with the shaft Q^4 , will stand still. The same is true of the parts connected with the shaft Q^3 when C' drives wheel C^4 . It can now be easily seen that the parts of the mechanism represented by K' , Ch , A^4 , A^6 (having even exponents) on the left are like those represented by K^2 , Ch' , A^5 and A^7 (having odd exponents) on the right; that C and C^2 are like C and C^3 ; that C^4 , C^5 , C^6 , C^7 , C^8 , C^9 , C^{10} , and C^{11} constitute a device common to the above two similar but independent devices which is acted upon alike by the two latter devices, in the first case from C^2 and in the next from C^3 ; and that D , D^2 , D^4 , D^6 and D^8 Fig. 44 are like D' , D^3 , D^5 and D^7 , Fig. 36 and that Q^3 and sb^2 are like Q^4 and sb^3 .

The similarity of mechanism just explained points to duplicate or multiple devices in safe-locking apparatus which operate in a similar manner and only differ in the fact that in one case one tumbler of a combination lock is set up, while in the other case a different but companion tumbler is set up for locking and unlocking purposes.

In the duplicate devices illustrated, the effect of concussion at K' passes to the arm a' , thence to the piece A^4 , Figs. 35, 36 and 45, which latter releases the notched and "time-of-running-wheel" B^6 and the stop wheel B and at the same time the pin p^7 of A^4 acts upon the lever A^6 raising its inner end and through the pin dc , the lever A^7 , and its detent da , releases the fan-regulated-train-wheel C^3 , and through such releasing the three-armed lever A^4 permits the spring of the spring-barrel sb^2 , to act on the shaft Q^3 and by its ratchet R and pawl P^5 to propel the "time-of-running-wheel" B^6 which rotates the sleeve s^6 to which B^6 , ratchet wheel C and cog-wheel C^2 are attached, and through the pawl p in wheel C^3 propel wheel C^2 in the direction of the arrow r^2 . The wheel B^4 acts on the pinion B^2 which drives the stop wheel B , Figs. 35, 36 and 44. The wheel C on the shaft Q^3 acts on C^2 which latter drives the fan-regulated-train, whose wheel C^9 drives the pinion C^{10} of the fan C^{11} . In the same manner the effect of concussion at K^2 passes to a' , thence to A^5 , which latter releases the notched and "time-of-running-wheel" B^7 and the stop

wheel B' and at the same time acts upon the lever A' and releases the fan-regulated-train wheel C' and through such releasing permits the spring of the spring-barrel s^3 to act on its shaft Q' and by its ratchet and pawl to propel the "time-of-running-wheel" B' the sleeve to which B', ratchet wheel C' and cog wheel B' are attached, and through a pawl p' in the wheel C' to propel the latter. Wheel B' acts on the pinion B' which drives stop wheel B'. Wheel C' acts on C' which latter drives the fan-regulated-train, whose wheel C' drives the fan-pinion C'. Going back to cog-wheel B' it drives cog-wheel D, Fig. 44, (see also Figs. 35, 36, 41 and 45) and its tumbler D', while cog wheel B' similarly drives cog wheel D', Figs. 35 and 36, and its tumbler D', and D carries pin D', Fig. 44, and raises the hammer c which strikes the gong D'. In the same way D' carries a pin D', Fig. 36 which raises the hammer c' and strikes the gong D'. The gongs D' and D' may produce different sounds and thus give instruction as to which mechanism or device is in motion and which is standing still as well as to indicate a particular position of a part as a tumbler. The pin D' can be placed in different holes o in tumbler D' and by changing the distance of the pin D' circumferentially from the notch n of tumbler D' change the combination, while tumbler D' Fig. 36 and its pin D' can be similarly handled. After gong D' rings, each stroke on K' (which permits D' to rotate) may measure any understood distance on the circumference of D'. In Fig. 45^a is shown a construction in which electrically controlled bells are operated when the tumblers are brought to an unlocking position. Depending from the upper inclosing plate is an insulated bracket D^{5x}, on the opposite sides of which are contact strips d^{5x} and d^{2x} . There are as many pairs of these strips as there are tumblers. Each pair of strips is normally in contact as shown and each strip of a pair is connected through a battery with a bell or alarm D^{5x}. The circuit is normally closed and the bell or alarm is constructed to be operated by a breaking of the circuit. Each tumbler is provided with a projection or tapet D^{4x} which will as the tumbler comes into the unlocking position strike the lower end of the contact strip d^{2x} of one pair of contact strips and break the circuit sounding the bell. The bells can be of different tones as hereinbefore described. For instance if pin D' is two holes from notch n of tumbler D' Fig. 44, and in the proper line of the motion of D' then two strokes on knob K' will bring the notch n of D' to the desired point for unlocking, and a similar proceeding may be had with the tumbler D'. It is seen that repeated blows or acts of concussion applied at K' trips mechanism which rotates until the gong D' is heard to ring, and thereafter other and a fixed number of blows will permit the rotation of the tumbler D' until it is carried to the desired point, it being observed

that while the left hand mechanism, operated from K', is in motion that operated from K' is standing still, and as with the left hand mechanism so with the right.

Fig. 36 besides presenting a front view of many of the parts just explained shows in addition thereto the angle-bar E which is acted upon by the beveled notches n of both the tumblers D' and D' which force the "racking stump" s^2 of the said angle bar to move out of the notches and ride upon the smooth circumferences of the tumblers until both of the notches are again brought into line at a point to receive the racking-stump s^2 of the angle-bar E. When the angle-bar E is forced out of the tumbler notches it acts on the dog E' and carries its stump E' into a notch n^5 in the door bolt E' which latter the dog holds until released. When the angle-bar E can rise in the tumbler notches the dog E' will be acted upon by its heavy end W through gravity and lift the other end of the dog E' clear of the notch n^5 in the safe bolt, which latter will then be free to be withdrawn.

The angle-bar E is attached at E', Figs. 36, 44 and 45, to the case C' of the concussion combination-lock, and the dog E' at s^5 , Figs. 36 and 45, to the inner plate P' of the safe-door, and the ends of these devices not connected with the tumblers or bolt-work are made the heavier.

Figs. 37 and 44, considered together, show how a time movement having (in this instance) a "ball-governor"-regulated mechanism such as shown in Figs. 8 to 21, and heretofore described, may have the unlocking device there presented controlled by a concussion combination-lock such as shown in Figs. 35 and 36 by the intervention of the disconnecter $d d$ and so that in case the time movement stops prematurely the hook V' cannot be disconnected from engagement with the bolt-work mechanism by means of the concussion-mechanism connected to the time movement or by any other means, until the concussion combination-lock is set up and the notched-hook G Fig. 37, is freed. The concussion combination-lock angle-bar E' is seen in Fig. 44 to be holding up by a link or disconnecter $d d$ the notched hook G of the tripping mechanism of Fig. 37 and as formerly explained, the hook V' of the time movement which has not been removed by the latter cannot then be removed by the concussion controlled and governor-regulated unlocking device, heretofore described, and shown also in Fig. 37, until the notched-hook G can engage with the pinion shaft d^3 of the time movement and hold it as described in connection with Fig. 38, so as to effect the removal of the hook V' and the notched hook G cannot engage the said pinion-shaft until the combination lock is unlocked and the angle-bar E lets its heavy end drop and carry the link or disconnecter $d d$ and its connections with it. The link or disconnecter $d d$ is pivoted at d^3 to the end of the angle-piece E and has

a slot d^3 sliding over a stationary guiding-pin d^7 connected to the case of the concussion combination-lock which guides the link vertically. This link or disconnecter carries the part d^4 having its upper edge so formed as to support and direct the notched-hook G by means of the pin pa in G and hold the notches of the hook G out of engagement with the pinion shaft d^3 of the time-movement as long as the link is held up by the angle-bar E, and yet the supporting edge of the part d^4 permits of an easy movement of the pin pa thereon when the concussion-train H J K runs. The guiding edge of the part d^4 is shown broken away to expose the notches in the notched hook G.

Where a concussion combination lock such as shown in Figs. 35, 36 and 45 is combined with a time-movement, and its releasing mechanism, as shown in Figs. 37 and 44, there is no need to unlock the concussion combination-lock every day if the dog E' is omitted because in that case the only device of the kind used will be the timer hook V' and this will generally be removed by automatic action each day, leaving it only necessary to use or unlock the concussion combination-lock and drop the disconnecter in case the time movement should fail to remove the hook V'.

To do the locking with the concussion combination lock shown in Figs. 35, 36 and 45, the lock is set in the unlocked position and that permits the dog E' to have its detent E³ ride upon the surface of one of the safe bolts E² and on closing the door the automatic safe bolt work moves in some known manner, as shown in Fig. 26, automatically into the locked position, as explained in connection with Fig. 34 bringing the notch n^5 of the safe bolt E² into which the detent E³ of E' is to enter directly under the said detent and then allow of a hammer on the knob K' and one on the knob K² frees the retaining pieces A⁴ and A⁵ and lets the springs of the spring-barrel sb and sb^3 act through the connected mechanism upon the notched tumblers D² and D³ so that the latter by the bevels of their notches and the corresponding bevel on the racking-stump s^2 of the angle-bar E will depress the racking stump which carries with it the dog E' forcing its detent E³ into the notch n^5 of the safe bolt E², as shown in Fig. 36, where the dog is held by the racking-stump s^2 riding on the rim of the tumblers D² and D³ and it will remain there and lock the safe bolt-work until the combination of the concussion combination lock is set up by two or three blows, say which will be sufficient to certainly effect the locking. A blow on the outside of the safe door, or on suitable steel plugs K' K², is conveyed inward along the respective dotted lines and acts upon the concussion hammer Ch or Ch' respectively; but the blow at K' will not produce the same effect on the hammer Ch' as on the hammer Ch, and vice-versa, since the blow at K' acts effectively along the line K'—Ch, only, and will produce an operating

effect on the concussion hammer Ch but will not produce such an effect on the concussion hammer Ch'; and through this fact I find myself able to get up a set of operations by blows at K' while the mechanism operated on through K² remains undisturbed. This feature of the manner in which concussion may be transmitted and is capable of acting enables me to produce many results by its aid; such as striking blows at certain selected points upon the safe door and thereby do unlocking through knowledge of an unlocking formula, as in the case of combination-locks; such points however being only some of numerous points that might be struck, and some if struck erroneously would defeat the object attainable when striking correct points, as, for instance, when such an unintelligently directed blow acted upon a secretly located device used for automatically locking or for signaling.

It is plain to see that any of the existing and well known combination-locks now in use which require rotation to the right and then to the left in order to set up their combinations may have such works performed by mechanism similar to that described herein for setting up my concussion combination-lock, because one of the spring-driven shafts, which is controlled by the train that I use in connection therewith, can drive to the right as many turns or fractions of a turn as may be desired while the other spring-driven shaft can be arranged to drive to the left when the turns or fractions of a turn are to be made to the left.

With the arrangement shown in Figs. 35 and 36 the wheels C² and C³ must always rotate in the same direction, but if "reversible transmitters" are used in connection with one of the shafts Q³, Q⁴ and the wheel connecting it with the tumbler shaft H', then the said shafts may be made to drive the tumbler shaft in opposite directions. Such reversible transmitters are described in my United States Patent No. 221,789, dated November 18, 1879, Fig. 1, Sheet 7, description page 3.

Fig. 46 shows one way of connecting an electro-magnet with a spring driven concussion-hammer placed exterior to the secure receptacle so that the latter may be tripped off and made to give a blow and generate concussion on the outside of the door, which force can then be communicated to the inside of the receptacle through its door in the manner described and for any of the purposes herein mentioned. In the arrangement shown in Fig. 46 A is a base plate adapted to be secured to the exterior of the door of the receptacle and the concussion knob K' on the exterior of the door projects forward through the plate A and a casing B attached to the plate A comes centrally over the knob K' and extends perpendicularly away from the door. Within the casing B is housed a hammer Ch which is adapted to slide longitudinally within the casing. A spring S interposed between

the casing end and the hammer Ch can force the hammer against the knob K' . A bent lever FG is pivoted at p' to the top of the casing and its horizontal arm F has a notch n which can engage and hold the lug o on the hammer Ch and which projects through and is guided in a slot sl of the casing B . The arm G of the bent lever FG extends upward and the proportions and the arrangement of the parts are such that a slight force only is required at the upper end of the arm G to retain the hammer in the position shown, and when considerable force is stored in the spring S . An electro-magnet may be connected with the bent lever FG in any suitable manner so that a medium current will be sufficient to perform the desired work.

In Fig. 46 an electro-magnet PP, RR is attached to the plate A and its armature PP is attached to the end of the upright lever l which is pivoted at p to a shell sh which projects from the plate A . A horizontal arm H^3 projecting from the lever l has a notch at its outer end adapted to catch and hold the free end of the arm G of the bent lever FG and thus retain the hammer Ch in the position shown. Within the shell sh is a spring s which is interposed between the plate A and the head J of the rod J' . The outer end of the rod J' presses against the upper end of the arm G and for the purpose of suddenly forcing this arm outward immediately that the electro-magnet causes the arm H^3 to release it. w, w' are wires which constitute portions of a circuit which may be led to any desired place, as a residence at a distance. An electrical battery may be located at any place and a circuit closer located at a residence, or any other desired place, so that a proper person only, may close the circuit and operate the device shown in Fig. 46 at will at any time desirable from the distant place, whereby the hammer Ch will be freed and be forced against the knob K' and thus made to impart a force of concussion at the desired point within a safe or secure receptacle and upon any desired locking or other apparatus or mechanism which may be located therein.

Simpler forms of apparatus may be used for the purpose last considered. Even an electro-magnet having a coil and spring-controlled magnetizing bar may be used alone. The bar would then be held and driven against the knob K' by its spring and would be withdrawn by the attractive force of the current acting against the spring. The latter form of electrical apparatus may be used to furnish the succession of blows required to operate my concussion screw devices yet to be described.

Whenever we use a spring driven concussion-combination lock, or time lock or other spring driven mechanism such as herein described which is entirely dependent upon the said spring for its motive-power there might be a time when such spring would have exhausted its force by running down. In any

spring or gravity-driven mechanism which has been described and all of whose parts are located wholly within the safe or secure receptacle it is plain to see that concussion can be used to reimpart to it potential energy, as by winding up its springs or weights, as in Figs. 49 and 50, and thereafter by a separate concussion device be made to release such wound up springs or weights so that these will be free to propel the said connected apparatus or mechanism, as in Figs. 8, 9, 10, 11, 20, 21, 30, 31, 35 and 36.

Fig. 49 shows a direct method of rewinding. The concussion hammer Ch there moves its arm a' so that the latter acts on the bell-crank CD which is pivoted to a support b' , moving its arm D that carries the pawl N' which acts on the ratchet wheel L^5 and turns the shaft Q^6 thus winding up the spring of the fixed spring barrel sb . However, a running-spring-barrel could be used here as shown in Fig. 50. The wheel L^6 runs loose on the shaft Q^6 and is driven in the direction of the arrow r from the ratchet L^5 by means of the pawl N^3 and may be the first wheel of any desired train; (the pin o and the lug o' on the pawl N' enabling the ratchet L^5 to turn in the opposite direction.)

Fig. 50 shows a method of rewinding by the action of concussion upon a wedge; the spring-barrel sb being arranged to turn, but the same apparatus can be arranged to wind the spring of a fixed spring-barrel. Here concussion is made to act on the hammer Ch moving its arm a^2 about its fulcrum p^4 so that its arm a' acts on the bell-crank CD which is pivoted at p^3 moving its arm D which acts on the pawl E that is pivoted to D at a^3 , and this pawl E acts on the rack R which is attached to the wedge W^2 and this wedge acts on the pin J by means of which the wedge is capable of turning the cog-wheel K^4 in the direction of the arrow r^3 , and the wheel K^4 rotates the pinion L^3 which turns the shaft Q^5 and its ratchet L^4 and winds up the main spring of the spring-barrel sb . L^5 is the first wheel of any required train and is attached to the spring-barrel and when the spring of the spring-barrel unwinds the pawl N and the ratchet L^4 prevent the shaft Q^5 from turning and thus enable the spring to drive the wheel L^5 and the barrel sb in the direction of the arrow r^2 . The pawl H^2 is attached to some fixed point as pa and has no reciprocating motion like the wedge W^2 but is movable about its pivot pa and can engage with the teeth t^2 of the rack R and hold the wedge against the rearward action of the spring s which connects with the wedge W^2 and is attached to a stationary part m^2 . The pawl H^2 holds the wedge W^2 where the pawl E moves it, but when pawl E moves the wedge far enough in the direction of the arrow r^2 to bring the pin p attached to the wedge in contact with the lug l on pawl H^2 further forward movement of the wedge will cause pin p to lift the pawl H^2 free of the rack R when the spring S will force the

wedge back to the starting point. The spring s bearing upon the flat part z of the pawl H^2 holds it out of engagement with the teeth of the rack R until the rearward movement of the wedge W^2 causes pin p' to strike the lug l on pawl H^2 and throw it again into engagement with the teeth of the rack, which places the wedge W^2 once more in position to be moved in the direction of the arrow r^4 . The pin v^8 acts to lift the pawl E clear of the teeth of the rack every time it draws back to engage with another tooth of the rack, at which time the hammer Ch rests in contact with the door P' , as shown, and therefore pawl E does not interfere with the action of the spring s when pawl H^2 is lifted clear of the teeth of the rack by the pin p .

Figs. 11, 13 and 39 show preferred forms of spring-barrels now in practical use which are adapted to be used with my apparatus.

Many ways of winding up might be shown but the above are deemed to be sufficient to inform those skilled in the art.

So far the effects of concussion have been described as being applied as means for releasing springs, or weights, or some form of apparatus or mechanism which is actuated after being released, by the force of springs or gravity, but concussion may constitute the motive-force which moves or operates any of the devices of safes or secure receptacles.

It will be seen hereinafter, where fully described, that a pawl attached to a concussion-propelled lever, swinging weight, or other device may be made to act upon a screw, or eccentric, or other mechanical appliance so that the latter will move or operate the devices of safes or secure receptacles, as, for example, moving safe-bolt-work into and out of the locked position, and this concussion device may be controlled by a concussion-timer or a concussion combination-lock, so that the time when it can act may be after such a lock has released it, or it may be at any other desired time. It will also be seen that a swinging lever and weight and a pawl may be made to drive or rotate a combination lock tumbler, such as previously mentioned, when it is properly arranged for the purpose, and by either direct or indirect action, and in this manner enable the operator to work out a combination known only to himself of a concussion combination-lock. The pendent pivoted hammers themselves, are examples of concussion propelled swinging-weights, as the hammer Ch in Fig. 45. Their arms are shown connected with mechanism in various ways which illustrate the application of a swinging weight to the propulsion of connected apparatus or mechanism.

Fig. 51 shows how the concussion hammer Ch can act through a bell-crank $G^2 G^3$ and a pawl G' directly upon the tumbler D^2 (or D^3) so as not to need springs for that purpose in Figs. 35 and 36.

We are able to make the force of concussion do the entire act of removing the hook

V' of the time-movement instead of merely using concussion to free a spring-driven wheel train, as a fan-regulated mechanism, which would then do such removing in the manner previously described.

In Fig. 52 the concussion hammer Ch carrying a pawl w is made to act through this pawl upon a ratchet D which is provided with a pinion E which drives a cog-wheel C , the latter being attached to the shaft of a screw W which works the worm wheel W^2 and the latter acts by a pin I (or by several similar pins if desirable) upon a tripping mechanism $E F G$ placed between the hook V' and the fourth wheel of the time movement. The hook V' , the piece $E E''$, and the rocking-lever F are all on the same shaft z , but the lever F and the piece $E E''$ are here fixedly attached to each other, or made integral so that motion of the one involves motion of the other and this device is loose on the shaft z and consequently the shaft may remain motionless while the rocking-lever F and the piece $E E''$ are in motion, or vice versa. The piece $E E''$ carries two pins, P' and O , so situated that the pin I in the worm-wheel W^2 can act on the pin P' and turn it a short distance about the axis of z , but far enough to let the pin I escape the pin P' when the pin I will go on until it comes into contact with the second pin O of the piece $E E''$,—provided the piece $E E''$ is held where it is carried by the worm-wheel pin I when acting on the pin P' . If the pin I acts on the pin O , also, then it will drive the piece $E E''$ about its shaft z and the lower arm E'' will come into contact with the pin P of the hook V' , and through it move the hook during the action upon the pin O out of the locking or guarding position. At the upper end of the lever F is pivoted the notched-hook G which is arranged to engage the pinion-shaft d^3 of the fourth wheel of the time movement, and this hook G is made to act just after the pin I of the worm-wheel W^2 has finished its work upon the first pin P' of the piece $E E''$, and if the pinion shaft d^3 is not moving then the notched hook G will hold to the shaft d^3 while the pin I moves on to act upon the second pin O of the piece $E E''$, in a time depending upon the distance between the pins P' and O and the speed of the wheel W^2 and the second action of the pin I carries the piece $E E''$ through its second motion and makes its lower end E'' act on the pin P and remove the hook V' from its guard. If, however the time-movement is in motion when the worm-wheel W^2 acts on the first pin P' of the piece $E E''$ and the worm-wheel moves on to act on the second pin O , then the notched hook G will be thrown off of the pinion shaft of the fourth wheel of the timer-movement by its motion in connection with the action of a spring (not shown but which is arranged to force the lever L away from the shaft d^3) and the spring will throw the rocking-lever F and the piece $E E''$ with its two pins P'

and O back into their original positions and do this so quickly that the pin I of the worm-wheel W^2 does not get to act on the pin O but moves in between the pins P' and O when the parts F, E E'', fly back without disturbing the piece E E''. As the piece E E'' must be carried two steps before it can act on the hook V' then it is clear that having only gone through but one of these steps no action is produced on the hook V' and therefore the guard of the hook is not disturbed. Hence, with the above arrangement if the time movement is running, you can not remove the hook V' from its guard, but if the time movement is not running then you can remove the hook. If desirable a second pin I^2 may be put in the worm-wheel W^2 to follow the first and if used this second pin will simply repeat the work done by the first pin. Among other values of the second pin I^2 is the value of repeating the work of the first pin I in less time than it takes to cause a full turn of the worm-wheel W^2 which would be required if but one pin were used in the worm wheel.

Fig. 53 is an end view of the device shown in Fig. 52 and does not need a separate description. The hook V' may be controlled in a similar manner by means of a double time-movement, as shown in Figs. 54, 55, 56 and 57, instead of by a single movement, as shown in Figs. 52 and 53.

Fig. 54 is a front view, Fig. 56 a top view, and Figs. 55 and 57 are end views of the device having a double time-movement. In this modification the screw W stands vertical and the operations of the parts are so similar to those shown in Figs. 52 and 53 that a full description is not necessary. Greater protection is afforded by the use of two time-movements, for they are so arranged and combined with the other mechanism that the stoppage of either movement cannot alone permit of the removal of the hook V' and it is necessary that both movements should be stopped before the hook can be removed from its guard over the bolt-work. To attain this end with the arrangement now being considered, the piece E E'' and the two rocking levers F and F' of the two movements are not fixedly united here, so that the motion of the piece E E'' shall compel both of the rocking levers F and F' to move by its pin P³ engaging them; the parts all being loose on the shaft z here, also, as in Figs. 52 and 53. Whenever the piece E E'' is moved contrary to the direction of the arrow r^3 the pin p^3 carries the rocking levers F F' with it, but if either rocking-lever should fail to hold by its notched-hook to the pinion shaft d^3 with which it may engage then the rocking lever which is not held will be driven back toward its original position by its spring (s or s') and will carry with it the piece E E'' and prevent the latter taking the second step required, as explained with reference to the action of the similar parts shown in Figs. 52 and 53, and therefore prevent any action of

the hook V'. If however both time-movements stop running then nothing exists to carry the piece E E'' back to its original position, and the weight of the part w^4 of the piece E E'' will hold it in place until the second action of the pin I of the worm-wheel takes place, but on the second pin O, now, of the piece E E'' which will move the piece E E'' and consequently the hook V'.

Fig. 54 shows bevel wheels V^2 and V^3 used to enable the screw W to stand vertical, and shows a bevel-wheel V^4 attached to a stem T that terminates in front of the front plate p^2 and is provided with a thumb screw ts . The wheel V^4 is made to engage the wheel G^3 which drives the screw W and thus effect the setting of the pins I and I^2 of the worm-wheel W^2 in relation to the pins P' and O of the piece E E''. The farther the pins I and I^2 of the worm-wheel W^2 are from the pins P' and O of the piece E E'' the greater will be the distance through which the worm-wheel W^2 will have to be moved by the concussion hammer $Ch.$, and as the concussion must be applied by successive blows on the outside of the structure to which the device is attached it is plain that such blows must be made more or less numerous in proportion as the distance between the pins I' and I^2 is increased or diminished. Consequently, it is obvious that even after either time movement stops, or the two time movements stop running we may still not be able to at once remove the hook V' from its guard over the bolt work but will be able to do so at a time later than that at which the movements stopped depending upon the setting of the worm-wheel pins I and I^2 . The shaft m of the worm wheel W^2 carries a pointer I' and the face of the front plate p^2 is to be divided and marked as dials usually are and by such means we are able to determine the relative positions of the pins I and I^2 of the worm wheel W^2 and the pins P' and O of the piece E E'', so that this arrangement constitutes a means for setting the worm-wheel W^2 . It requires only ordinary skill to arrange that the concussion hammer Ch shall act upon a screw as W, through a ratchet as D, as shown in Figs. 54, 55, 56 and 57, and that this screw shall propel a worm-wheel, as W^2 , whose shaft drives another screw which may turn a second worm-wheel, which latter may then act upon a piece, as E E'', Figs. 52 and 53 or in Figs. 54, 55, 56 and 57. Such an arrangement would multiply the number of blows required to remove the guard of the hook and in this way extend the time required to remove the said guard after the time movement stopped running. Evidently such an operation could be extended indefinitely, and therefore through such an arrangement of devices we may, to all practical purposes, determine when entrance to a structure guarded by them shall occur subsequent to a premature stoppage of the time movements and we see how such effects may be prevented before the time movements stop prematurely.

I regard the above means and modes of operation as a fair showing of my ability to control and apply concussion intelligently for industrial purposes as has never before been done; particularly, so as to positively effect a known and desired purpose only as and when needed or desirable.

Figs. 30 and 31 show the combination of a timer with a concussion train of wheel work having an eccentric whose object is to move bolt work into and out of the locked position, Fig. 30 being a front and Fig. 31 an end view of the parts shown. H J K is a train of wheels and L is a detent lever pivoted at I² and engages the wheels H J K in the same manner as described in connection with Fig. 8. Q' is a shaft corresponding in position to the star-wheel-shaft Q' of Fig. 8 and may be the driving shaft of the train H J K as in Fig. 8 or the shaft of one of the wheels H J K or any other wheel in the train, may be the driving shaft. Any suitable means as a spring or a weight may supply the power for driving the train H J K and turning the shaft Q', and any number of wheels and any number and length and power of springs may be employed which may be required to move or operate positively any of the devices herein described and in any desired time. On the shaft Q' is an eccentric C, which, in this particular application is arranged to work in a slot *sl* in the carrying-barb of the safe-bolt-work; the slot *sl* only, being shown in Fig. 30, the carrying-bar and other parts of the bolt-work having an arrangement similar to that shown in Fig. 58. However the slot *sl* may be found in any other device to be moved by such a wheel train. V' is the hook of the time movement and is shown in the position occupied when the bolt-work is locked and so held by the timer. The hook V' is here supposed to perform other functions as in other cases.

Ch, Figs. 30 and 31, is a concussion hammer, similar to that shown in Figs. 20 and 21, and is adapted to similarly connect with and operate the detent lever L. In Fig. 31 the shaft I², lever L, and wheels J, only of the train-mechanism above described are shown. In Figs. 20 and 21 the end *a'* of the hammer Ch is shown in contact with the end *e'* of the lever L, but in Figs. 30 and 31 the arm *a'* of the hammer is held out of contact with the end *e'* of the lever L, say about one-thirty-second of an inch, and as indicated by the space between the lower edge of the hammer arm *a'* and the dotted line *z³-z³*, Fig. 31. A is a part firmly supported, say by the door plate Pl, Fig. 31, and *b* is a bar connected by a pin *c* to a timer hook V' and arranged to rest and slide upon the part A. *b* in Fig. 31 is in section along the line *z²-z²* of Fig. 30. When the bolt-work is in the locked position and the timer hook V' is in the controlling position shown then the free end of the bar *b* projects under the end of the hammer arm *a'* to the vertical, line *z-z*, say, Fig. 30. A spring *s'*, Fig. 20, keeps the hammer Ch against the door plate Pl and

the arm *a'* raised, thus permitting the bar *b* to freely slide under the latter. When the bolt-work is thrown and the timer has control of the hook V' and holds the bar *b* under the hammer arm *a'*, as shown here, concussion if imparted to Ch cannot act upon the lever L for the bar *b* will intercept it, but when the timer moves the hook V' in the direction of the arrow *r^b* and draws the bar *b* the distance between the vertical lines *z-z* and *z'-z'* Fig. 30, then concussion if applied to the hammer Ch will bring the hammer arm *a'* in contact with the arm *e'* of the lever L and force it down and the lever L out of engagement with the train H J K when the power of the train will rotate the shaft Q' and the eccentric C and withdraw the bolt-work.

Fig. 47 shows the hook V' of the timer arranged so as to operate in connection with a concussion device for moving safe-bolt-work. The timer which controls the hook V' is not shown here but is supposed to be connected with the hook as in Figs. 12 and 13.

The safe door P', P², P³ is shown in section through the center of the knob K' and portions of the bolt-frame B' and the carrying bar CB and one of the bolts E² are shown in their relative positions. The carrying bar CB has a lug V³ having a hole *h* through which the screw V⁶ passes. This screw is preferably supported as shown in Fig. 48, where the same letters indicate the same parts, and where the screw shaft V⁶ is countersunk at its ends *o-o* and a center-point *o'* secured to the bolt frame B' supports one end and a center-point *o'* secured in any suitable frame-piece *f* supports the other end. A ratchet wheel V⁵ is placed on the shaft V⁶ and a nut V⁷ is placed in the rear of the lug V³ and is held against the back side of the carrying-bar so as not to turn, as shown at *x*, and so that when the wheel V⁵ turns the shaft V⁶ in the direction of the arrow *r'*, the shaft being free to rotate, only, the screw will pull the nut V⁷ and the carrying bar CB and draw the bolt E² out of the locked position. A concussion hammer Ch is pivoted at *c'* to the support *a* and rests in contact with the door plate Pl opposite the knob K'. To the hammer arm *c³* at *c²* is pivoted a pawl holder V³ and multiple pawls 1, 2, 3, 4, are pivoted to V³ at *c-c*. The teeth of the wheel V⁵ in front of the pawls are cut away to show that the pawls are of different lengths, whereby they are able to act independently upon each tooth, so that if one pawl does not catch a tooth others will, and so that the least motion of the wheel will be taken up by the pawls even when the teeth are pretty coarse. It is plain that blows applied upon the knob K' will cause the hammer Ch to move and drive the pawls forward and cause them to turn the wheel V⁵ and the screw V⁶ and thus withdraw the bolt-work. A similar arrangement could be arranged for moving the bolt work into the locked position. It is easily seen that by simply raising the hook V² of

the pawl holder V^3 and hooking it into the notch n^2 of the timer hook V' so as to hold the pawls 1, 2, 3, 4 out of engagement with the ratchet V^5 the action of the hammer Ch can not operate the wheel V^5 and the screw V^6 . The timer may thus control the action of the device shown in Fig. 47 any desired time, and when guarding the said device no force can be effective to withdraw the bolt work through the screw V^6 . It is also seen by Figs. 47 and 48 that the screw V^6 and the nut V^7 are not attached to the lug V^8 or to the carrying bar, and hence the bolt work may be automatically withdrawn without disturbing the concussion hammer Ch and the ratchet arrangement. The device shown in Fig. 47 may be similarly placed under the control of a concussion combination-lock or an independent concussion screw device.

Of course the bolt work being automatic, will of itself move as soon as started, or disengaged from some holding device and therefore but little force will be required to move the screw V^6 , but in case of necessity the device shown in Fig. 47, being a form of concussion screw device operated by means of the continued application of blows at K' can be made to perform the entire work of withdrawing the bolt-work.

Fig. 58 shows means similar to the above for both shooting and withdrawing safe bolt-work. Here I use a shaft Q^7 , a ratchet wheel R^2 , and an eccentric C , and place them so that the eccentric may work in a suitable hole or slot sl cut through the carrying-bar CB of the safe bolt work. The ratchet R^2 is on the shaft Q^7 and near to the inner plate Pl of the safe door and this shaft is perpendicular to the safe door. The shaft Q^7 has one end supported by the door and its other end supported by the piece D which is attached to the frame-bar B' . I attach a bell crank BC' to the door by means of the support I and the pivot I' and apply the spring s which tends to move it in the direction of the arrow r toward the left. To the upper end of the lever B and by means of the pivot p I attach the two-armed multiple pawl device $F E$; the multiple pawls to act on the ratchet R^2 and the end F to act by the pin p^2 through a slot sl' on the lever MG which turns about the fixed pivot I' . To the door at $m m'$ I attach a concussion hammer Ch which is kept in contact with the door by means of a suitable spring, as usual but not shown here, and whose arm a' is in contact with the top side of the pawl carrier F at a pivot between the pivot p and the pawl pivot o . I attach another concussion hammer Ch' by the pivot k and support K to the door and cause its arm a' to come in contact with the under side of the arm C' of the bell-crank BG' . The end M of the lever MG is shown in contact with the hook V' of the timer and where the lever is holding the hook in the unguarding position. In the front side of the eccentric C I place a pin c so that it may when C rotates, act on the arms c' ,

c^2 of the hammer c^3 , c^4 and ring the bells c^5 , c^6 . It is seen in Fig. 58 that the eccentric C is in the position where its longest radius extends toward the frame-bar, at which time the safe bolt work is in the locked position. If we now cause the multiple pawl carrier F to be depressed by the hammer arm a' it will in turn depress the pawls E and force them out of engagement with the ratchet R^2 and at the same time the other end of the pawl-carrier F will act upon the lever arm M by the pin p^2 and release the end M so that the notch n^2 of the hook V' will catch it and retain it until the action of the timer moves the hook V' in the direction of the arrow rb and withdraws it from engagement with the lever M , and when this is done the weight of the lever MG and the connected end of the pawl-carrier F being greater than that of the parts on the right of the pivots I' , p , elevates the pawls E until they engage with the ratchet R^2 again. If now concussion be transmitted through the door to the concussion hammer Ch the latter will transmit the force upward against the end of the arm G' of the bell-crank BG and move the pivot p and the parts FE supported thereby toward the ratchet R^2 , which action drives the ratchet around in the direction of the arrow r' , and hence repeated blows of the hammer Ch' will turn the eccentric C out of the position shown in the figure, which then pulls back the carrying-bar CB and the attached safe-bolt E^2 and unlocks the safe or receptacle. Immediately that the pawls E are driven toward the ratchet R^2 the spring s acts upon the upright lever B and forces back the bell crank BG' until its end c' is arrested by coming into contact with the arm a' of the concussion hammer Ch' . When the eccentric pin c comes into contact with and trips the bell-hammer-arm c^2 it rings the bell c^6 and announces that the throw of the eccentric is at its farthest point toward the timer and that the safe bolt-work is unlocked. If the strokes are continued on Ch' until the bell c^5 is rung the bolt-work will have been again moved into the locked position (shown) and at which time if concussion be applied to the hammer Ch its arm a' will depress the pawls E and move them out of contact with the ratchet R^2 and raise the end M of the lever $M G$ until caught by the notch n^2 of the timer-hook V' which would then move in the direction of the arrow va by means of its usual spring and would hold the lever M until it was released by the timer when the operation of unlocking could be repeated with the concussion apparatus.

The pawls P' are for the purpose of preventing the ratchet R^2 from being drawn back by frictional contact with the swinging pawl E when the latter are drawn back to renew their work on the ratchet. The spring s^2 fastened to F holds the pawls E up and enables them to catch the ratchet teeth easily, but in a manner not to prevent their being entirely disengaged by the hammer Ch .

When a safe door is made without a hole in it, or when the construction of the door is such that it is equivalent to a door without a hole in or through it, and having automatic bolt-work, and where the timer has not been operated by the usual means outside of what I have devised and have for the first time in this specification described, there is no way to determine whether it is the timer which has failed or the automatic bolt-work. Under such circumstances concussion if applied blindly or without control would be of no avail as means for starting, operating, or stopping lock mechanism without injury thereto, but with my system concussion is never applied except intelligently and so that the operator is aware of each and every effect or action which results therefrom and which takes place out of his sight within the safe or secure receptacle and without a particle of injury or danger of injuring even, to the lock mechanism within. With my system concussion may be applied first to release the hook V' of the timer without acting upon the automatic bolt work and should unlocking not then occur it is thereby known that the trouble is with the automatic bolt work and concussion may then be applied to it and cause it to operate as herein described.

A bell may be connected mechanically with the hook V' of the timer in such a manner as to announce the moment the hook has been removed from engagement with the bolt-work, so that if the bell is heard to ring and the safe door cannot then be opened positive knowledge is had that it is the bolt work which will not operate.

An electric bell may be used at any desired place within or without the safe or secure receptacle and the apparatus be so arranged that a circuit will be made when the hook V' is withdrawn, and which can be maintained as long as the hook remains in the withdrawn position, so that the electric bell will continue to ring until the true state of affairs is made known. It is also evident that a concussion device such as shown in Fig. 27, may be set at some secret place on the safe door and so that it will control a dog which will be thrown into the locked position by any one who tries to unlawfully enter by force; because concussion of a violent character, such as produced by dynamite, when applied with a view of bouncing off the guarding locks will have the effect of releasing the dog held by the secretly located device, and yet the latter can be arranged so as not to act during any of the ordinary locking or unlocking operations induced or effected by concussion, because this force can be made to act effectually upon the locking apparatus and mechanism only when acting in direct lines, and thus it can be made to produce effects upon one piece of apparatus or mechanism which it will not produce upon a similar piece which is located out of the direct line of travel which the force of concussion tends to take, and this is true even

when the point where concussion is ordinarily applied is in the immediate vicinity of the secret point, as explained in connection with Figs. 35 and 36.

The preferable principle of operation and control of such devices for use in safes and secure receptacles as herein described and as shown in Figs. 4 and 21, is where the force or motion is transmitted to the primary apparatus or mechanism in curved lines, as arcs, but I contemplate the transfer of the force of concussion to such primary devices of the apparatus or mechanism of safes or secure receptacles in straight lines as well as where the force of concussion is received upon the end of a bar having means for guiding it in a straight line, as illustrated in an elementary manner on the first sheet of the drawings.

The fan-regulated concussion device, or other similar device having a spring-driven wheel-train set in operation, merely, by concussion, as previously described, except as to one or two blows required to set it in operation, is an automatic device clear down to the point of removing the guard of the hook V' of the timer but the concussion screw device shown in Figs. 47 and 48 and the devices to be described are not automatic, as the effects of concussion which move and operate them depend upon the force obtained from a succession of blows with a hammer that may be administered by a person, or an automatic device as described in connection with Fig. 46, and in the same sense that a nail driven into a piece of wood by the blows of a hammer is a positive acting means of effecting a desired purpose, so is the concussion screw-device one having a positive action, and in the sense that bolt-work has positive action when its arbor is turned by a person as in either case greater or less force may be applied at will to effect a given purpose.

A time movement is automatic and may expend its whole force inside of a secure receptacle in an effort to accomplish a result, or it may stop its action before its force is expended and before such result is attained, and in either case fail, but with the concussion screw device connected as I have explained with a time movement that is so situated as to control or act in connection with the concussion screw-device, such failure of the time movement may not only be provided against but sufficient force is made available, according to the requirements of the case, to effect the desired result pertaining to moving or operating any locking apparatus inside of safes or secure receptacles. In the same way automatic safe-bolt work may expend its force in an effort to produce a desired result inside of a secure receptacle, or it may fail, and when it fails there is no way in a receptacle having no hole through it by which to increase or vary any deficient force so as to effect the desired purpose, but if we properly connect my concussion screw-device with any form of automatic bolt-work we may transfer from the

former to the latter such additional force as will effect the desired result in connection with unlocking in much the same way as we do with the time-movements above referred to.

5 I shall now explain how I construct an automatic bolt-work and connect it with the concussion screw device. I arrange a going spring-barrel *sb*, Figs. 59, 60 and 61, so as to have a train of wheels G I K terminating in a fan M that is to regulate the speed. I connect the spring barrel *sb* by a pinion B with a cog-wheel C which drives a shaft Q⁹ that carries an eccentric E which latter acts on a link L that is united to the carrying bar, or some other movable part of the ordinary multiple safe bolt-work, such as is now most commonly in use, and therefore requiring no special description. The spring-barrel *sb* rotates in the direction of the arrow *r* carrying its pinion B with it and moving the cog-wheel C and the eccentric E in a reverse direction causing the link L to move forward and backward under the continued motion of the spring-barrel, and if we consider the link L when carried as far in one direction as the eccentric E will carry it as placing the connected safe-bolt work in the locked position then when the eccentric carries the link as far as it can in an opposite direction we may consider that the safe bolt-work has reached its unlocked position, but when the locked position is reached it is desirable to stop further action of the spring-barrel and hold the eccentric in that position for that period of time during which it is desirable to maintain the structure locked, and after the expiration of such time to permit the spring-barrel again to move onward and effect unlocking and when unlocking has been accomplished to stop any further action of the spring-barrel and hold it until the time for maintaining the structure unlocked has expired and then permit the spring-barrel to again effect the locking as before.

45 Figs. 59, 60 and 61 illustrate how the well known going spring-barrel *sb* causes the eccentric E to assume the locked and the unlocked positions as above described, and how the well known train G I K which terminates in the fan M prevents a too speedy action of the spring-barrel *sb* and therefore a further description of these parts need not be made. The mechanism which is to stop the motion at the locked and unlocked positions, however, so as to secure locking for any desired period and then permit unlocking and allow unlocking to exist as long as desired and thereafter be susceptible of reproducing locking requires a more detailed explanation.

60 To provide automatic means for starting, stopping and holding the mechanism as described, I first connect the cog-wheel C which drives the eccentric E with the train G I K at its stop *s* or fan M and then connect these devices by the same apparatus and the hook V' of my concussion timer, or other timer,

and do it by means of two three-armed stop levers 1, 2, 3, and a trip lever 4, 5, 6, Figs. 63, 64, 65, 66 and 67. The three armed stop lever 1, 2, 3, I fulcrum at 7 in the middle partition on supporting piece W³ and the other three armed trip lever 4, 5, 6, I fulcrum at the point 8 on the upper outer part of the case C', bringing the arm 3 through the case and into operative reach of the arm 4 of the lever 4, 5, 6. The forked arm 1 of the stop lever 1, 2, 3, reaches to the stop *m* of fan M of the train and the arm 2 of that lever reaches into an annular groove *g* cut in the face of the cog-wheel C and concentrically with its center, as seen in Figs. 63, 64, 65, and 66. The three armed trip lever 4, 5, 6, is provided with two pins *p*¹ and *p*² on one of which *p*¹, a rearward projection *j* of the hook V' of the timer acts. On the other pin *p*² a forwardly projecting pin *y* of the hook V' acts. The trip lever 4, 5, 6, is also provided with a spring *s*³ acting on the arm 6 tending to force a motion in the direction of the arrow *rl*. The stop lever 1, 2, 3 is so made and placed that whenever the gap 9 in the forked end or arm 1 is in position to permit the projection *m* of the fan M to rotate freely through the gap then the other arm 2 of the lever is in the annular groove *g* of the cog-wheel C and will then permit of the rotation of the wheel C. In the piece W³ I locate a spring *s*⁴ so that it can act on the arm 2 of the stop lever 1, 2, 3 and force it upward, Figs. 64 and 65, and make it reach radially out of the annular groove *g* at a point suitable to stop the eccentric in the locked position, and I cut a notch *i* in the inner arm of the annular groove *g* at this point and cut another notch *b* at a place diametrically opposite to the first but on the outer rim of the groove; both notches being of a size to admit of the entrance of the end of the arm 2. I make the spring *s*³ stronger than the springs *s*⁴ because the former must overcome the latter when unlocking is to be done, but to provide against a possible failure of the spring *s*³ I arrange that the pin *y* of the hook V' of the timer shall set on the pin *p*² of the lever 5 and perform the same operation which the spring *s*³ is intended to do, and do it whenever the spring *s*³ fails to do its work. Another function of the pin *y* is to prevent the turning of the trip lever 4, 5, 6 and thus prevent the device getting locked up until the timer is wound for producing unlocking, and this will be seen by an inspection of Fig. 67, where it appears that the pin *p*² of the trip lever 4, 5, 6 will strike the pin *y* of the hook V' whenever the latter is in the unlocked position, shown in Fig. 67, and therefore winding the timer which moves the hook and its pin *y* is necessary before the trip lever 4, 5, 6 can be moved by hand to permit the eccentric E to assume the locked position. After the arm 5 has been moved by hand, in the direction of the arrow *va*, as much time as one-half minute, more or less, will pass before the

timer can move the hook V' into position to lock with the bolt-work, which is ample for closing the safe door.

We will now consider the mechanism in the locked position, shown in Figs. 64 and 66, and describe what is to be done to effect unlocking. Suppose the concussion timer has removed the hook V' from its guard carrying its projection *j* clear of the pin *p'* of the trip lever 4, 5, 6, and that immediately thereafter the spring *s*³ pulls the arm 4 against the projecting end of the arm 3 of the stop lever 1, 2, 3, overcomes the spring *s*⁴, withdraws the arm 2 of the stop lever 1, 2, 3, from the notch *b*, Fig. 64, and presses it against the upper side of the annular groove *g*, then the gap 9 of the forked arm 1 is in position to allow of the motion of the fan M and the train G I K and consequently motion of the spring barrel *sb* and the cog-wheel C, and suppose that such motion ensues. This motion of the cog wheel C will continue until the notch *i* of the annular groove *g*, used at the unlocked position, is brought round so that the arm 2 of the stop lever 1, 2, 3 can enter it and bring the proper fork of the arm 1 into the path of the stop *m* of the fan M, with the eccentric in the unlocked position, and stop further motion, shown in Figs. 65 and 67.

In the above operation the arm 2 of the stop lever 1, 2, 3 moves out of the notch *b* into the annular groove *g* and then into the notch *i*, and the upper fork of the arm 1 moves up bringing the gap 9 of the arm 1 into the path of the stop *m* and stops the train in the unlocked position. The motion of the trip lever 4, 5, 6 then is produced by the spring *s*³, or, that failing, by the hook V' acting through its pin *y* on the pin *p*² of the lever 4, 5, 6.

We will next consider the mechanism in the unlocked position, shown in Figs. 65 and 67, and describe what is to be done to effect locking. First wind the time movement. When wound, the usual spring of the hook V' will move it toward the locked position until the projection *j* of the hook strikes the pin *p'* of the trip lever 4, 5, 6. Then take hold of the arm 4 by the hand and move the trip lever 4, 5, 6 against the spring *s*³ and about its fulcrum 8 in the direction of the arrow *va*, Fig. 67. As soon as the pin *p'* of the trip lever 4, 5, 6 has been moved out of the way of the projection *j* the hook V' will go on into the locked position, and thereby bring its projection *j* in front of the pin *p'* and hold the trip lever 4, 5, 6 in the locked position shown in Figs. 64 and 66. When the trip lever 4, 5, 6 is moved by hand, as above, and so as to clear the arm 3 of the stop lever 1, 2, 3, as takes place in Fig. 67, then the spring *s*⁴ that acts on the arm 2 is free to force this arm out of the notch *i* and against the outer rim of the annular groove *g* and keep it there until the notch *b* that is used to effect locking comes round and permits the spring *s*⁴ to force the arm 2 up into this notch and at the same time place the upper fork of the arm 1 of the stop

lever 1, 2, 3 in the path of the stop *m*, thus stopping the train G I K, spring-barrel *sb*, cog, wheel C, eccentric E, &c., and producing locking.

It must be noticed in proceeding from the unlocked to the locked position as last described, that the spring *s*⁴ moves the lower fork of the arm 1 out of the line of motion of the stop *m* and places the gap 9 in position to permit motion of this stop, and then motion of the train G I K, spring-barrel *sb*, cog-wheel C, and the eccentric E begins, and continuing, brings the notch *b*, used to effect locking, into proper position so that the spring *s*⁴ can force the arm 2 up into the notch *b* and bring the upper fork of arm 1 into the path of the stop *m* and stop the motion of the wheel C, and the eccentric E in the locked position. Such automatic bolt-work using an eccentric, has probably never before been used simply because of the danger that existed in case anything should fall into the path of the bolt-work when it moves toward the locked position and before it fully reaches that position. In that case owing to the continuous motion of the eccentric, the springs could not be used to retract the bolt-work until the latter first reached the locked position and as the condition named presumes that the locked position is not entirely reached, therefore the springs would act to keep the automatic bolt-work in this obstructed condition and locked, even when these devices have the usual means for preventing unlocking removed therefrom. If however an impediment should fall in the path of the same bolts when they are moving to effect unlocking, the case would be different, because under such a condition the springs are always acting in the direction to effect unlocking and the safe door could not be caught and held, whereas under the former condition the springs always act in a direction to cause locking. I have not, however, been deterred for any of the above reasons, or for other causes, from using the continuous eccentric action for automatic bolt-work, because I command in concussion a force which can be applied in a manner and of sufficient amount to draw back such automatic bolt-work from any position it may reach in its progress from the unlocked to the locked position; further, such concussion apparatus can be so connected with the eccentric acting automatic bolt-work, such as I have herein described, as to be under the control of the concussion timer and, therefore, not be effective to act to withdraw such bolt-work until the timer permits.

I shall now describe the means which I use to overcome any failure which may arise in using eccentric automatic bolt-work and when I describe these means I will have shown how to produce non-lock-out automatic bolt-work by the aid of concussion, as, in describing a non-lock-out timer, I have shown how concussion may be employed in connection with the timer to prevent a lock-out.

On the shaft Q^9 of the eccentric E and cog wheel C, Figs. 59, 60, 61, 63, 64, 65, I place loosely the worm-wheel W^4 which I rotate by the screw W and cause the latter to rotate under the action of the concussion hammer Ch and its pawls w and ratchet D which is attached to the shaft m^2 of the screw W. To prevent any back action of the screw W I use the pawls w' which secure in the usual way all of the advance which the ratchet wheel D makes. If the worm-wheel W^4 , screw W, ratchet wheel D, pawls w and w' , and the concussion hammer Ch, were not in some manner connected with the eccentric E and the cog wheel C, or their shaft Q^9 so as to act upon them in a direction opposite to the usual way in which the eccentric is moved by the main springs then the only effect of blows on the outside of the structure would simply result in moving the worm-wheel W^4 round and round on its shaft Q^9 without molesting the above mentioned apparatus, were the wheel W^4 loosely mounted thereon; and such in fact is the only result which I want to have the power to produce, except when the main springs and mechanism connected therewith fail to do the unlocking; and when the main springs do fail then I want the timer to automatically effect a suitable connection between the shaft Q^9 and the worm wheel W^4 so that the motion of the latter will cause a motion of the shaft Q^9 and consequently of the eccentric E and the cog-wheel C in the reverse direction.

I shall now describe the means by which I connect the shaft Q^9 with the worm wheel W^2 and show that such connections can be made only when the timer permits it. Referring to Figs. 68, 69, 70, 71, and 72, I drill an axial hole h in the end of the shaft Q^9 and place therein a coiled spring s^5 and then a plunger P^4 of either the shape shown in Fig. 69 or Fig. 70. I also cut into the shaft Q^9 three mortises or slots sl which start on the outer circumferential surface of the shaft and go radially toward its center and reach into the above described axial hole in the shaft Q^9 . I then provide three blades or spokes b^2 of the shape shown in Figs. 69 and 70 of suitable size to enter the above described slots sl , and I form projections j^2 at their inner ends adapted to enter axial holes drilled into the plungers P^4 and P^5 , as shown in Fig. 70. The width of the blades b^2 is less than the length of the mortises or slots sl and therefore they may enter the slots and be shoved back against the plunger P^4 notwithstanding the projections j^2 . When the blades b^2 are in place I put into the outer end of the axial hole of the shaft Q^9 another plunger P^5 having a hole drilled into its rear end to receive the forward projections j^2 of the blades b^2 . These blades project beyond the circumference of the shaft like spokes from the hub of a wheel. I now bore a hole through the center of the hub of the worm-wheel W^4 , Figs. 68 and 70, large enough to fit snugly the shaft

Q^9 and then counter bore into the side of the hub a recess ss having such a depth and diameter as will permit the blades b^2 to enter the recess and allow the worm-wheel W^4 to be turned about the shaft Q^9 without disturbing the blades or tending to move the shaft while these blades are in the said recess. At six places in the recess I again cut into the hub of the worm-wheel W^4 so as to form six slots sl' capable of admitting the blades b^2 whenever they are opposite these slots and free to move forward into them. Next I attach the lever l by a screw a to the hub h^2 of the worm-wheel. If now I press on the front plunger P^5 I will move it, all of the blades b^2 , and the plunger P^4 inward until the blades b^2 reach the limit of the slots sl , and then I draw down over the front and pointed end of the plunger P^5 the lower arm l' of the lever ll' , which will hold the blades b^2 , and when in this position they are within the worm-wheel recess ss and with the spring s^5 always tending to press the plungers P^4 and P^5 and the blades b^2 outward. With such an arrangement, it is evident that the blades b^2 must remain within the hub of the wheel W^2 until the lever l' is removed from the plunger P^5 and as soon as this lever is so removed the spring s^5 will act to force the blades b^2 forward and will do so if the slots sl' are opposite the blades. I now arrange a lever l^2 in connection with the lever l and put it under control of my concussion timer causing it to so act whenever the concussion timer is off guard or unlocked, and only at such a time, that it will be in the path of motion of the lever l when the latter is carried around with the worm-wheel W^2 as it rotates in response to the screw W which moves it. If now we place the lever l^2 in the position shown in Fig. 71 and leave the lever l out of its reach then any amount of rotation of the worm-wheel W^2 will never remove the lever l from the plunger P^5 and as long therefore as this condition prevails the worm wheel W^4 can never have an operative connection with the shaft Q^9 , because the timer lever l^2 is out of reach of the lever l and the arm l' holds the blades b^2 away from the slots sl' of the worm-wheel. If however timer lever l^2 is brought into reach of the lever l then the arm l' will be moved away from the plunger P^5 by the worm-wheel W^4 bringing the lever l into contact with the lever l^2 and then the spring s^5 acting outward, will force the blades b^2 into the slots sl' of the worm-wheel, as soon as the latter brings the slots sl' opposite the blades b^2 , when connections between the worm-wheel W^4 and the shaft Q^9 will be established. Then the force of the screw W can be exerted to withdraw the bolts by moving the eccentric E backward. By such means, unlocking of the eccentric automatic bolt work can be accomplished regardless of whether there has been an obstruction that prevented these bolts reaching their full locked position or not, and regardless also of the breakage even of all of the main-springs,

or regardless of many other accidents that might happen to automatic bolt-work to prevent unlocking. I thus produce positive non-lock-out automatic bolt-work which is a result that has never before been accomplished to my knowledge.

In case we desire to withdraw the safe bolt-work by the operation of the concussion hammer *Ch*, screw *W*, worm-wheel *W*⁴, eccentric *E* and link *L*, Figs. 59, 60, 61 it is obvious that with the arrangements so far shown we might reach the unlocked position of the said bolts, and not being aware of it, might keep on and relock. To avoid this trouble, I place between the eccentric *E* and the worm-wheel *W*⁴ another wheel or disk *B*³ having a single tooth *t*³ which acts upon the inner end of a lever *L*² that is pivoted at *f* to the case *C'*. This lever has its end *w* beveled and arranged to act upon a pin *p* of the concussion hammer *Ch* and draw the latter away from contact with the inner safe plate. This lever *L*² has its other end so situated that the tooth *t*³ of the wheel or disk *B*³ can engage the end of the lever and move it in a direction that will make its wedge end *w* engage the pin *p* of the concussion hammer *Ch* and move the latter away from the door of the safe. The tooth *t*³ of the disk *B*³ is properly placed with reference to the eccentric *E* so that when the unlocked position is reached the tooth *t*³ will move the lever *L*² and withdraw the concussion hammer *Ch* and stop further motion of the worm-wheel *W*⁴, eccentric *E*, and the bolt-work at the unlocked position and in that way avoid the trouble above suggested.

With the above arrangement I am compelled to cause the screw *W* and the worm wheel *W*⁴ to wind the main spring and train *G I K* backward at the same time that I do the work of withdrawing the bolts. To avoid the work of winding the main-springs up and running the train *G I K* backward, I disconnect them before I begin to cause the screw *W* and worm-wheel *W*⁴ to do the work of withdrawing the bolts. In order to disconnect the main-spring-barrel and its attached train from the cog-wheel *C*, eccentric *E* and their shaft *Q*⁹, I unite the spring-barrel *sb* and its pinion *B* by means of a number of pins *p*³ attached to the pinion *B* and arranged to loosely enter holes *o* in the front end of the spring-barrel *sb*, as shown in Fig. 75 and permit the pinion *B* and pins *p*³ to be withdrawn from the front end of the spring-barrel. I turn a groove *g*³ around a hub *h*³ on the front end of the pinion *B*. To the end of the case, or the cap *C'*, Fig. 74, I attach a bracket *b*³ and to the cap *C'*, I attach at the pivot *p*³ a bent lever *l*³ *l*⁴ one end *w'* of which passes outward through the cap *C'*, Figs. 73, 74, 75, 76, and the other end reaches down to the shaft *Q*¹⁰ of the spring-barrel and by a right angled turn goes back to the front end of the pinion *B* and rests on a loose collar *c*. To the bracket *b*³ I attach the bell crank or clutch lever, *C' C*²

arranging the upper end *C'* to engage the corner *w*² of the lever *l*³ *l*⁴ and provide the lower forked part *c*² with the pins *p*⁶ which work in the groove *g*³ of the pinion hub *h*³ in the usual manner of making clutch connections. In order to keep the lever *l*³ *l*⁴ in place and so that its end *w*³ shall rest against the collar *c* and in front of the hub *h*³, I use the spring *s*⁶ causing it to press the end *w*³ against the collar *c*, Figs. 73 and 76. With the two levers *l*³ *l*⁴ and *C' C*², the bracket *b*³, spring *s*⁶ and the pinion *B* made and connected as described, I am able with the worm wheel *W*⁴ and its connections to withdraw the pinion *B* from the spring-barrel *sb* and make the disconnection proposed. But the lever *l* of the worm-wheel *W*⁴ and the lever *l*² which is operated by the timer must co-operate to effect this disconnection and must be so made that such co-operation will only take place when the timer permits. I make these levers *l* and *l*² as shown in Figs. 73 and 75 where the lever *l* appears near to but not in engagement with the end *w'* of the lever *l*³ that comes through the cap *C'*, and the lever *l*² is seen to have been placed by the timer against a pin *p*⁵ in the cap *C'* and so that its end *v*² will be struck by the pin *p*⁴ of the lever *l* when the worm-wheel *W*⁴ brings it around; and when contact takes place between the levers *l* and *l*² the worm-wheel will move on carrying the lever *l* along, but the pin *p*⁴ will be obstructed by the end *v*² of the worm wheel lever *l*² and the lever *l* will therefore be turned about its fulcrum *a* and its end pin *p*⁴ will be drawn radially toward the center of the worm-wheel and its lower end *l'* will be drawn from the plunger *P*⁵. The pin *p*⁴ acts on the end *w'* of the lever *l*³ *l*⁴ where it comes through the cap *C'* and pulls it downward turning the lever *l*³ *l*⁴ about its fulcrum *p*³ and, having lifted its end *w*³ from in front of the pinion *B*, moves on and acts on the clutch lever *c' c*² and causes it to draw the pinion *B* from its connection with the spring barrel *sb*. The corner *w*² of the lever *l*³ *l*⁴ moves from the position at the dotted line *x-x* up to the dotted line *x'-x'* Fig. 74 while the end *w*³ is being lifted from in front of the pinion *B*, and before the pinion is moved any.

e is an eccentric cam pivoted at *pa*, Figs. 73, 75, and 76, *pa*, Fig. 73 being a button; the hole for its stem only being shown in Fig. 75 at *pa*. The object of the cam *e* is to lock the arm *l*³ when down to keep it from rising as soon as the pin *p*⁴ disengages from the end *w'*, and thus prevent the spring *s*⁷ pushing the pinion *B* back into connection with the spring-barrel *sb*. The dotted radii and arcs in the figures show the relative motions of the parts in performing given steps.

It is plain to see by Figs. 71, 72 and 73 that the removal of the timer lever *l*², so that it could not be reached by the lever *l* would let the pin *p*⁴ pass over the end *w'* of the lever *l*³ without pulling down the end *w'* and operating the clutch *c' c*² and without withdrawing

the pinion B, because the pin p^4 would pass above the end u' of the lever l^3 and the lever l^3 of the timer, being removed to the left, the worm wheel lever l would be carried on undisturbed and would perform no other function than to retain the plunger P^5 in place. It is also seen by the above description that in case the three levers l^2 , l and l^3 , l^4 come into contact as described the result will be: first, to disengage the spring-barrel sb and the train G I K; second, to free the plunger P^5 from the end l' of the worm wheel lever l so that spring s^5 may act to force the blades b^2 into the slots sl' of the worm-wheel w^4 , and third, that further turning of the worm-wheel w^4 will bring the slots sl' opposite to the blades b^2 and permit the spring s^5 to force the blades into the said slots and make the connection between the worm-wheel W^4 and the cog-wheel C and the eccentric E with the shaft Q^9 for the purpose of withdrawing the safe bolt-work as required.

There is a possibility but not a probability that two prejudicial things might occur at the same time in connection with the joint action of my concussion timer and my concussion automatic eccentric bolt-work namely: first, the time movement might fail to remove its hook from its guarding position, and second, the concussion device of the concussion timer might fail to do the work which the time movement had failed to do. This remote contingency can easily be provided for by arranging a device like the day-wheel of the fan-regulated mechanism so that at one place it operates upon the hook V' of the concussion timer and at another place it may be operated upon by suitable connection with the worm-wheel W^4 . With such a device properly set, it could be made to require ten or more full turns of the worm-wheel before the day-wheel device would act upon and withdraw the hook V' from the guarding position, and if each full turn of the worm-wheel W^4 required four hours' time then ten turns would take forty hours and that would be ample time to defend the structure from attacks in this direction, by burglars and therefore such an arrangement could be left to itself to act at any time and under any circumstances; for it could not be overcome in a burglar's time and would be a positive and reserved means of entrance whenever all other means had failed; and such an arrangement would act as well to guard the failure of combination locks of various forms of automatic bolt-work as it would for the timers and the particular bolt-work which I have herein referred to.

In the device shown in Figs. 59, 60 and 61 I have used three wheels G I K in the train to enable the fans acting on the air to serve as a sufficient regulator, but with the arrangement shown in Figs. 77 to 80 only one train wheel is used between the spring-barrel sb and the fan M. On the shaft of the pinion P I cut a screw s and around this shaft I place

a coiled spring s^2 fastened at a to the pinion P and at b to a barrel or sleeve B that incases the pinion shaft s^3 and the spring s^2 . The barrel or sleeve B is of the shape shown in Figs. 78 and 79 and is provided with a thread at the end m within that is suitable to operate with the thread s on the end of the pinion shaft s^3 . By means of the screw s on the shaft s^3 , the thread in the barrel or sleeve B, and the spring s^2 , I form a connection between the pinion shaft and the barrel or sleeve. On the outside of the barrel or sleeve B is a feather f which works in a slot in the hub h^3 of the fan M and runs the whole length of the barrel or sleeve B. The fan M also has a hub h^3 which surrounds the barrel or sleeve B that covers the spring s and the pinion shaft s^3 and the barrel or sleeve B is connected by its feather f to the slot of the fan-hub h^3 and the latter is connected with an enlarged part of the pinion shaft ss at n which permits free motion of the fan-hub h^3 around it but will not allow any endwise motion of the barrel h^3 along the shaft s^3 . At the end m of the barrel or sleeve B there is room for the barrel or sleeve to move endwise along the pinion shaft but whenever the barrel or sleeve so moves it engages the end c of a lever cd fulcrumed at p^2 in the partition W^3 , and whose other end d presses against the exterior of the spring-barrel sb so as to communicate the effect of the endwise motion of the barrel B to the surface of the spring-barrel. Another arrangement for a similar purpose is shown in Fig. 80 where a similar barrel or sleeve B is provided with a disk d' which rubs against the end of the plugs z , which are pressed by the springs s^4 whenever the barrel or sleeve B moves toward these plugs. The more forcibly the barrel or sleeve B presses against the lever cd or the springs s^4 the more resistance is offered to the action of the driving-spring of the spring-barrel sb in propelling the fan M. If the spring-barrel sb moves in the correct direction it will drive the fan M faster than the spring-barrel in the proportion of the difference between the size of the spring barrel wheel A and that of the pinion P^3 , and that motion is multiplied again by the large cog wheel G playing into the pinion P. This arrangement of the mechanism by means of the connection between this pinion P and the fan M gets up enough velocity in the fan, which is comparatively a large fan, to cause air resistance to hold the fan back more or less while the pinion P can be driven forward. If the pinion P thus gains on the fan M the spring s^2 will turn and tighten and the barrel or sleeve B will be turned about the shaft s^3 and in turning will be carried by the screw s against the lever cd or by the screw s and disk d' , against the spring plugs z , and the greater the resistance of the feather f and fan M the more will the barrel or sleeve B turn and the more the latter turns the greater will be the pressure on the lever cd or the springs s^4 . The resistance to the motion of the fan M

is in proportion to the velocity of the pinion P and it is thus seen how the devices shown act to regulate the motion of the spring-barrel *sb*. If desirable a regulator may be made by placing the fan-barrel *h*³ directly on the pinion shaft *s*³ so that the fan-hub can have longitudinal motion only on the pinion shaft and then inclining the fan-blades to the axis of the shaft so that they will act on the air as a propeller acts on the water, and cause the shaft *s*³ to drive the hub *h*³ of the fan M against the lever *cd*, or the spring-plugs *z*, and thus cause a regulating action such as might be desirable in using such a device. When motion in the fan M ceases, the spring *s*³ will cause it to regain its original position and free the sleeve B from contact with the lever *cd* or the disk *d'* from the spring-plugs *z*, and thus free the device to be started again by the force of the main-springs of the spring-barrel *sb* without any hinderance from the lever *cd* or the spring-plugs *z*.

In my concussion eccentric automatic bolt work it will be useful to introduce some means for turning the ratchet wheel D, Figs. 59, 60 and 61, against the pawls *w* which rotate the screw W and against the pawls *w'* which retain all of the advance of the ratchet D, for the purpose of releasing strain, adjusting the device, or for setting the levers *l l'* in relation to the lever *l*² of the timer, Figs. 68 to 76; and as all of these devices are located within the case C' I accomplish this by operating upon the ratchet D as follows: to the case C' I attach the lever *l*⁵ fulcrumed at *v*³ to the end of the case and in one end of this lever I place a pin *p*³ and near to the propelling pawls *w*, and place a pin *p*⁴ near to the retaining pawls *w'*. I drill two holes *u u'* into the ratchet D and place in these holes the coiled springs *s*⁵. The upper end of the lever *l*⁵ has a beveled end or projection *n* to permit a knob-key *k* having a conical face-rim to act upon the end *n* of the lever *l*⁵ and turn it about its fulcrum *v*³ whenever the knob-key is connected to the ratchet D by having its two pins *p*⁵ and *p*⁶ placed in the holes *u u'* of the ratchet and the knob-key is pressed inward and turned round, the beveled rim on the key acting to press the beveled end *n* of the lever *l*⁵ radially outward from the center of the ratchet D and cause the lever *l*⁵ to disengage the pawls *w* and *w'*. The knob-key may then turn the ratchet D, screw W, and the worm-wheel W⁴ in either direction without hinderance from the pawls *w* and *w'*, as the end *n* of the lever *l*⁵ will ride upon the conical rim of the knob-key. The object of the springs *s*⁵ is to act upon the pins *p*⁵ and *p*⁶ of the knob-key and automatically push the latter outward so as to free the lever *l*⁵ and permit it to drop to its normal position and allow the pawls *w* and *w'* to re-engage with the ratchet D. As these springs disengage the said parts automatically there is no danger when leaving the knob key in place of preventing

the pawls *w* and *w'* from engaging with the ratchet.

I have now shown automatic bolt-work which uses an eccentric to produce locking and unlocking by a continuous action or a continuous forward motion of the eccentric, and cause this motion to be produced by two suitable flat clock-springs wound about the same arbor side by side in the same spring barrel, and specify that either of said springs is capable of doing the locking or unlocking, the extra spring being provided as a reserve in case of the breakage of one spring and hence a failure from such cause can not occur. I further call attention to the fact that such automatic bolt-work is made to perform its entire operations without noise because there is no lost motion as would be caused by reversing the direction of the motion, no matter whether these or other springs are used to move or withdraw the bolt-work.

Figs. 82 to 90 show how a tripping mechanism connects the hook V' and the fourth wheel pinion shafts *d*³ of a double time movement so that when either notched hook G or G' is thrown out of engagement with its pinion shaft then the remaining hook is unable to retain the shaft *z* in the first position of the two positions required to accomplish the removal of the guard of the hook V'. Fig. 82 is an end view partly in section of the device shown in Fig. 83, and as the devices shown in Fig. 82 to 90 are very similar the view in Fig. 82 will serve for all of the other modifications.

Figs. 83, 84, 87 and 88 show one modification of tripping apparatus, and Figs. 85, 86, 89 and 90 show another modification. These two modifications operate in substantially the same manner but differ in construction; the first modification shown is believed preferable on account of being simpler of construction and easier to make and requires no pins as *m, n*, Figs. 85, 86, 89 and 90, and further is a new form, the second form having been used previously. In all of these figures but one rocking-lever F is used. In Figs. 82 and 83 each notched-hook, G G' is pivoted at a point *c* to the upper end of the lever F by a link *a*. When not operated upon by the pins I, &c., of the worm-wheel W² the loose piece E rests at the side of the lever F as shown in Figs. 83, 84, 85, 86, 87 and 89. If one of the time movements is running it will always throw the corresponding notched hook off of its pinion shaft and prevent the guarding hook V' being moved. In order that the hook V' may be moved by the piece E'' both of the notched-hooks must hold, as in Figs. 88 and 90. In Figs. 83 and 85 both hooks fail to hold and as the result of either hook being thrown off by its pinion shaft. In Figs. 84 and 86 the left hand hook G' is shown as holding but without the piece E'' being moved. In Figs. 87 and 89 the right hand hook G is shown as holding and without the piece E'' being

moved. In Figs. 88 and 90 both notched-hooks hold and the piece E'' is moved through its second motion and moves the timer hook V' from its guarding position.

5 Fig. 81 is a perspective view showing how the piece E E'' acts on the two rocking levers F and F', how the notched hooks G and G' act on the pinion shafts d^3 , and how pins I, I² and I³ act on lugs of pins P' and O of the
10 piece E E''. This figure also shows each of the notched hooks G and G' provided with two notches 1 and 2 and how these hooks act on the pins *pa* and *pb*, in the front or back plates, and lift the hooks clear of the pinion
15 shafts d^3 and thus prevent them from dragging or resting on these shafts while they are in motion.

Besides the particular arrangements of parts and devices herein described and illustrated which are applicable to safes and secure receptacles I contemplate modifications and arrangements which will be suggested by the description and illustrations and hence do not limit myself to any particular arrangement or construction of means set forth; the illustrations presented simply serving to explain the principles underlying the means set forth whereby I am enabled to apply concussion intelligently and under control in connection with moving or operating devices used for various purposes, as in, on, or upon safes and secure receptacles. Other variations or arrangements of the essential apparatus or mechanism shown and described are within the ordinary skill of any one made acquainted with the devices which I have shown and described herein and therefore further or other modifications need not be given.

40 What I claim, and desire to secure by Letters Patent, is—

1. The art of utilizing the force of concussion which consists in applying concussion to a rigid integral or composite solid body, transferring said force from said solid body to a
45 movable mechanical element, and controlling said force to give a predetermined methodical movement to said element, substantially as described.

2. The art of applying and utilizing the force of concussion which consists in applying
50 concussion to a rigid integral or composite solid body transferring said force from said body from the side of said body opposite to that to which the concussion is applied to a
55 mechanical element, and controlling said force to give a predetermined methodical movement to said element, substantially as described.

3. The art or process of utilizing and controlling the force of concussion which consists in imparting repeated concussion to a rigid body and transferring each impulse of said
60 concussive force to an actuating element of an organized mechanism, substantially as described.
65

4. The art or process of utilizing and controlling the force of concussion to give con-

tinuing motion to an organized mechanism on one side of a composite or integral or rigid body from the other side of the same which
70 consists in applying repeated concussion to said body and transferring each impulse of said concussion force from the opposite side of said body to an actuating element of said
75 mechanism as described.

5. The process of actuating mechanical devices within a hollow closed structure which consists in applying concussion to a wall of said structure on the outer side of the same, imparting the force of said concussion to said
80 devices from the inner side of the same and controlling said force to give a predetermined methodical movement to said devices, substantially as described.

6. The combination substantially as before set forth of safe securing devices, with concussion devices for controlling the same or parts of the same, said concussion devices adapted to receive motion from concussion and to act on parts directly combined there-
90 with.

7. The combination with an integral or composite solid body, of mechanism adapted to be operated in the regular manner for the purposes of its organization, by the concussion of said solid body, said solid body isolating the said mechanism from the locality where concussion is to be applied, substantially as described.

8. The combination substantially as herein before described, of an integral or composite solid body, with a primary device adapted to be operated by the concussion of the solid body, and a device for imparting concussion to said solid body, said solid body isolating
105 the device to be actuated from the device producing concussion.

9. The combination substantially as described of an integral or composite solid body with a primary mechanism adapted to receive motion from the concussion of the solid body, one of the elements of the said primary device being in contact with the said solid body and having definite modes of motion, whereby the concussion of the said solid body
115 will move said element to impart a predetermined movement to other connected parts of the device.

10. The herein described combination of safe securing devices for the door of said safe, and mechanism combined with said securing devices having an element in contact with a wall of said safe and adapted to be moved away from said wall in a regular and predetermined manner by the concussion of the same and to actuate other elements of the mechanism to effect a movement of parts of the safe securing devices.

11. The herein described combination with door retaining devices for secure or safety inclosures, including locking mechanism of a concussion device for controlling a part of said retaining devices.

12. The herein described combination of

door retaining devices for secure or safety inclosures including locking mechanism, and a concussion device for directly actuating a part of said locking mechanism.

5 13. The herein described combination of safe securing devices comprising among its members, automatic operating mechanism for controlling a part of the safe securing devices and a concussion device for freeing or setting
10 the automatic mechanism in operation.

14. The primary concussion device substantially as herein described comprising a body adapted to be supported against a solid body and receive motion therefrom by the concussion of the said solid body on another side of
15 the same and a device combined therewith to be moved by said supported body.

15. The herein described primary concussion device comprising a weight or hammer
20 adapted to be supported in contact with an integral or composite rigid body and receive motion therefrom by the concussion of the same and devices combined therewith to be moved by said weight or hammer in a regular and predetermined manner.
25

16. The herein described primary concussion device consisting of a weight or hammer arranged to turn about an axis and held in contact with an integral or composite solid
30 body and other devices combined and connected with said weight or hammer at or near its fulcrum whereby said weight or hammer is adapted to be moved in an arc by concussion of the said solid body and to move the
35 devices connected therewith in a regular and predetermined manner.

17. The herein described primary concussion device consisting of a weight or hammer arranged to turn about an axis, a spring holding it in contact with an integral or a composite
40 solid body, and other devices combined and connected with said weight or hammer, at or near its fulcrum to be moved thereby, the said weight or hammer moving in an arc
45 away from the said solid body when acted on by concussion and toward the said body when acted upon by the said spring.

18. The combination hereinbefore set forth of an automatic mechanism comprising actuating means adapted to store energy with a
50 primary concussion device for controlling said mechanism.

19. The combination with a secure receptacle and a permutation lock mechanism for
55 said receptacle of a concussion device for controlling parts of the lock mechanism, substantially as described.

20. The combination substantially as hereinbefore set forth of safe securing devices
60 consisting of time lock mechanism, permutation lock mechanism, and automatic bolt work, with concussion devices for controlling parts of said securing devices.

21. The combination substantially as hereinbefore set forth of safe securing devices,
65 consisting of a timer and automatic bolt work,

with concussion devices for controlling parts of the said securing devices.

22. The combination substantially as before set forth of safe securing devices consisting of permutation lock work and automatic
70 bolt work with concussion devices for controlling parts of the said securing devices.

23. The combination substantially as before set forth of a timer, a concussion controlling device therefor, permutation lock
75 mechanism, a concussion controlling device for the same, automatic bolt work and a concussion controller therefor.

24. The combination substantially as before set forth, of a timer having the usual dog
80 or hook, a spring actuated gear train for moving said dog or hook, a concussion trip for said gear train, a concussion device for moving said dog or hook, a permutation lock
85 mechanism controlling the connection of the said gear train and timer, a concussion controlling device for said permutation mechanism, safe bolt work and a concussion controller for the same.
90

25. The herein described combination of a secure receptacle, with securing devices for the same, a spring actuated mechanism for moving parts of the securing devices, and a
95 concussion device for winding the spring of said actuating mechanism.

26. The herein described combination of a secure receptacle and its securing devices of spring actuated mechanism for moving parts
100 of said securing devices, means for winding said spring mechanism when the parts are accessible and a concussion device for winding the spring mechanism when the parts are
105 inaccessible.

27. The herein described combination of a secure receptacle and its securing devices,
110 with a mechanism actuated by stored energy for moving parts of said devices and a concussion device for restoring energy to said actuating mechanism.

28. The combination hereinbefore set forth of an automatically operated mechanism including one or more revolving parts with
115 parts normally engaging and arresting said revolving parts at a certain point of their revolution and a concussion device for momentarily tripping said engaging parts whereby a single movement of said concussion device will permit a predetermined amount of
120 movement of said automatic mechanism.

29. The combination with a time lock mechanism and its dog or hook of a spring actuated train of gearing having connected parts
125 adapted to operate said dog or hook and having a regulator or governor moving in one direction only, and a concussion device for releasing said spring actuated gearing substantially as described.

30. The combination with a time lock mechanism and its hook or dog of a tripping
130 mechanism therefor comprising a spring actuated lever a notched arm adapted to engage a shaft

of the time lock mechanism, an intermittent moving mechanism for said lever and a concussion device for controlling said moving mechanism, substantially as described.

5 31. The combination hereinbefore set forth of a spring actuated wheel train, a spring pressed pivoted lever having parts to engage and hold moving parts of the train and a concussion device for momentarily releasing said
10 lever.

32. The combination hereinbefore set forth of a time lock mechanism and its hook or dog, a trip for said hook or dog comprising a pivoted lever and an attached hook arm adapted to engage a shaft of the time mechanism, a
15 notched or ratcheted part connected therewith, a pawl engaging said notched or ratcheted part, a spring actuated gear train for reciprocating said pawl, and a concussion device for controlling said gear train.
20

33. The combination hereinbefore set forth of a time lock mechanism with its hook or dog, a trip for said hook or dog comprising a pivoted lever and an attached hooked arm adapted to engage a shaft of the time mechanism, a
25 toothed or ratcheted segment connected with said lever, a pawl, an actuating mechanism for said pawl comprising a spring actuated gear train including an eccentric and a concussion device for tripping the gear train.
30

34. The combination hereinbefore set forth of a time lock mechanism with its hook or dog of a tripping mechanism for said hook or dog comprising a pivoted lever having a toothed
35 segment connected therewith, an arm connected with said lever having notches corresponding with the teeth of the segment adapted to engage the shaft of the time mechanism, a pawl for engaging and moving the segment
40 and lever intermittently, a spring actuated mechanism for moving said pawl and a concussion trip for the pawl actuating mechanism.

35. The combination substantially as before described of a time mechanism and its hook
45 or dog, of an automatic gear train for tripping said dog or hook and a button lever for momentarily releasing said gear train.

36. The combination substantially as before set forth of a secure receptacle, locking mechanism therefor attached to a wall of the said
50 receptacle with a yielding and deadening substance between them yielding and deadening material between said locking mechanism and the connections securing it to said wall, and
55 a concussion trip for said locking mechanism having a movable part in contact with a wall of the said secure receptacle.

37. The combination hereinbefore described of a time lock and its hook or dog, a tripping
60 mechanism for said hook or dog comprising a pivoted lever and connected to a notched arm adapted to hook on to a shaft of the time mechanism, a spring retracting said lever and hook and a spring actuated mechanism for
65 advancing said lever and hook toward said shaft by a step-by-step movement and a con-

ussion device for controlling said spring actuated mechanism.

38. The combination substantially as before set forth of a time lock mechanism, with its
70 dog or hook, a spring actuated gear train for tripping said dog or hook, a lever for engaging and holding a moving part of said gear train, a concussion device for momentarily tripping
75 said lever and releasing said gear train, and a trip for said lever connected with the said dog or hook, whereby the timer dog will trip the gear train when the timer in its usual
80 operation removes its dog or hook and the concussion device can be actuated to trip it if the timer prematurely stops.

39. The combination substantially as herein described of a time lock mechanism with its dog or hook of a catch for engaging said dog
85 when "off guard" and a concussion trip for releasing said catch.

40. The combination hereinbefore set forth with a secure receptacle of locking mechanism therefor secured to a wall of the receptacle with a yielding and deadening material
90 between them and a concussion device for moving a part of said locking mechanism in direct contact with a wall of the receptacle.

41. The combination substantially as before set forth of time lock mechanism, its hook or
95 dog, and connected bolt work, of a trigger forming a supplemental dog for the bolt work and a concussion trip for said trigger.

42. The combination substantially as before set forth of a time lock mechanism and its
100 connected bolt work, a concussion trip for a part of said devices, and an electrically controlled hammer for operating said trip.

43. The combination herein described of a time lock mechanism with its hook or dog of
105 a combination lock, having a part engaged and controlled by said dog, bolt work controlled by said combination lock and a concussion device for moving said timer hook or dog and releasing the combination lock.
110

44. The combination herein described with a timer dog or hook and the angle piece pivotally connected therewith of a moving part
115 of the timer provided with a projection having a surface for engaging and retaining engagement with the angle piece of the timer dog or hook, for a certain period and concussion devices coacting with said parts.

45. The combination substantially as before set forth of timer dog or hook, the dial provided with a projection to operate said dog or
120 hook and the angle piece pivoted to the dog or hook having a limited movement about its pivot whereby the same may be engaged to move the dog or hook by the projection of the dial when the latter is moving in one direction
125 only.

46. The combination substantially as before set forth of secure receptacle, a time lock mechanism with its dog or hook within the
130 same, and a concussion controlled trip for said dog or hook, the concussion hammer of the

said trip being located at a distance from the time mechanism and operatively connected therewith by rigid connections.

47. The combination substantially as before set forth of a time lock mechanism and its dog or hook, of a spring actuated gear train for tripping said dog or hook, a spring lever engaging and holding said gear train and a concussion device for tripping said lever located at a distance from the timer and gear train but connected with said lever.

48. The combination, substantially as before set forth of a secure receptacle, a time lock mechanism with its hook or dog within said receptacle a concussion controlled gear train for tripping said hook or dog, an electric controlling device for said gear train located within said secure receptacle and connected with said gear train a circuit for said electric device extending outside of the said secure receptacle and a circuit controller for the same.

49. The combination substantially as before set forth of a gear train, a device for storing energy for actuating the same, a device for releasing and stopping the gear train by engaging with one or more of its parts at certain definite points of their movement and a concussion trip for said releasing and stopping device including a pivoted concussion hammer.

50. The combination substantially as before set forth of a permutation lock mechanism, a gear train operated by stored energy connected with a tumbler of said locking mechanism and a concussion device for controlling said gear train.

51. The combination substantially as before set forth of a permutation lock mechanism, a spring-actuated gear train connected with one of the tumblers and another spring actuated gear train connected with another of the tumblers of the said lock mechanism and an independent concussion device for controlling each gear train.

52. The combination herein set forth with a permutation lock mechanism of a series of gear trains connected with parts of said lock mechanism consisting of two or more of said gear trains, concussion devices for independently controlling said gear trains, and a shaft having a wheel connected with each gear train said connection including a pawl and ratchet construction, whereby said wheel can be moved independently by each train while the other trains are at rest.

53. The combination, substantially as before set forth of a permutation lock mechanism of a spring actuated gear train connected with one of the tumblers and another gear train connected with another tumbler of said locking mechanism, regulating mechanism common to both gear trains and an independent concussion device for controlling each gear train.

54. The combination substantially as herebefore set forth with permutation lock

mechanism of a series of spring actuated gear trains connected with parts of said lock mechanism consisting of two or more of such trains, concussion devices for independently controlling each gear train, a separate gear wheel connected with each gear train and geared with a speed regulator moving in one direction only, the said connection of said trains with said separate gear wheel including a pawl and ratchet construction, whereby said speed regulator will act with such trains as are in operation without moving the others.

55. The combination substantially as before set forth of a secure receptacle having integral or composite solid walls of a series of independent concussion devices consisting of two or more such devices having their actuating hammers in contact with the same wall at different points thereof, whereby concussion applied to the walls to actuate the hammers of one device will not operate that of another.

56. The combination substantially as before set forth with permutation lock mechanism of a series of gear trains connected with said mechanism consisting of two or more of such gear trains, concussion devices for independently controlling said gear trains, independent gear wheels connected with said gear trains, and a separate gear wheel connected with each gear train and geared with a speed regulator moving in one direction only, the connection of the gear trains with the separate gear wheel including a pawl and ratchet construction.

57. The combination substantially as before set forth of a time lock mechanism with its dog or hook, permutation lock mechanism and bolt work controlled by the said dog or hook, a concussion device for tripping the dog or hook of the time mechanism and a disconnecter controlled by the permutation mechanism detaching the concussion tripping device from the time mechanism.

58. The combination, substantially as before set forth of a time mechanism with its dog or hook, bolt work controlled by said dog or hook, a concussion device for tripping said dog or hook, including a hooked arm for engaging a shaft of the time mechanism, a permutation lock mechanism, and a lever and link controlled thereby lifting said hooked arm out of position to engage the time mechanism.

59. The combination, substantially as before set forth of a time lock mechanism with its dog or hook, a bolt work controlled by said dog or hook, a concussion device for tripping said dog or hook, a permutation lock mechanism—also connected with and controlling said bolt work a disconnecter controlled by the permutation mechanism detaching the said concussion device from the timer and additional concussion devices for controlling the permutation mechanism.

60. The combination substantially as before set forth of a permutation lock mechanism

and a concussion device for controlling the same.

61. The combination, substantially as before set forth of a locking mechanism, concussion devices controlling the same and bells connected with the locking mechanism for indicating the position of its parts.

62. The combination, substantially as before set forth of a locking mechanism, concussion devices for controlling the movements of the same and bells of different and distinguishable sound connected with the lock mechanism for indicating the position of different parts of the lock mechanism.

63. The combination, substantially as before set forth of a secure receptacle, of movable parts within the same, concussion devices controlling the movement of said parts, and electric bells connected with the said parts for indicating predetermined movements of said parts, whereby said bells can be located within the safe or outside of the same and at any distance therefrom.

64. The combination substantially as before set forth of a secure receptacle, locking mechanism located therein, concussion devices for moving parts of said mechanism and an electrically controlled hammer located on the outside of the secure receptacle for actuating said concussion devices.

65. The combination, substantially as before set forth of a secure receptacle, locking mechanism located therein, a concussion device for moving a part of said mechanism and an electrically controlled spring hammer located on the outside for actuating the said concussion device.

66. The combination, substantially as before set forth of a locking mechanism for safes, including automatic devices for actuating parts of the same, winding mechanism including a wedge and other parts and a concussion device operatively connected with said winding devices whereby said devices can be operated from the exterior of the safe.

67. The combination, substantially as hereinbefore set forth of a secure receptacle, locking mechanism therein, including spring actuated devices for moving parts of the same, winding devices for the spring actuating mechanism and a concussion device connected with said winding devices by connections including a pawl and ratchet.

68. The combination, substantially as before set forth of bolt work, a gear train and actuating means therefor, and an eccentric connected with said gear train whereby the bolt work is moved into and out of locking position and means for reversing the movement of the said eccentric.

69. The combination, substantially as before set forth of bolt work and automatic mechanism for actuating said bolt work and supplemental actuating devices for said bolt work including concussion actuating means, whereby the bolt work can be moved when the automatic devices fail to do their work.

70. The combination, substantially as before set forth of safe bolt work and concussion controlled devices for moving the same.

71. The combination, substantially as before set forth of safe bolt work, devices for moving the same and a concussion device for acting upon a part of said devices.

72. The combination substantially as before set forth of safe bolt work, automatic mechanism for actuating the same and an independent concussion device for moving the bolt work when the automatic devices fail to do their work.

73. The combination substantially as before set forth of safe bolt work having reciprocating bolts, a spring actuated gear train for moving said bolt work, and a concussion device for moving the bolt work, independently of the gear train.

74. The combination substantially as before set forth of safe bolt work having reciprocating bolts, an eccentric operatively connected with the reciprocating bolts, a spring actuated gear train moving an eccentric and a concussion device for independently moving said eccentric when the gear train fails to do so.

75. The combination, substantially as before set forth of safe bolt work having reciprocating bolts, an eccentric operatively connected with said bolts, a spring actuated gear train for moving said eccentric, and concussion devices for moving the said eccentric when the gear train fails to do so including a worm or screw and a worm wheel.

76. The combination, substantially as before set forth of safe bolt work having reciprocating bolts, a spring an eccentric gearing connecting said spring and eccentric including a clutch, and a concussion hammer and gearing connecting said hammer and said eccentric including a worm and worm wheel, whereby the spring can be disconnected from the eccentric when it is desired to move the bolt work by concussion.

77. The combination, substantially as before set forth of safe bolt work, the concussion hammer, worm, worm wheel, the eccentric, a projection moving with said eccentric, a lever and the hammer pin.

78. The combination, substantially as before set forth of a time lock mechanism with its dog or hook, the automatic bolt work including the grooved cog wheel, the stop lever, and the trip lever engaging the dog or hook.

79. The combination, substantially as before set forth of a time lock mechanism with its dog or hook, the automatic bolt work including the grooved cog wheel and a fan provided with stops, the forked stop lever, and the trip lever engaging the dog or hook.

80. The combination substantially as before set forth of a time lock mechanism with its dog or hook, the automatic bolt work including the cog wheel having the annular groove with a notch in its outer and a notch in its inner side, and a fan having stops, the

forked stop lever, its spring and the trip lever engaging the said hook or dog.

81. The combination, substantially as before set forth of safe bolt work, an eccentric 5 operatively connected with said bolt work for moving the same, a concussion hammer and gearing intermediate the hammer and eccentric including a clutch whereby the hammer 10 may be connected with and disconnected from said eccentric.

82. The combination, substantially as before set forth of safe bolt work, an eccentric operatively connected with said bolt work for moving the same, a concussion hammer, a 15 worm, a worm wheel mounted loosely on the eccentric shaft, a clutch the spring pressed plunger engaging the movable part of the clutch, and a lever pivoted on the worm wheel and having an arm adapted to retain said 20 clutch against the action of the spring plunger.

83. The combination, substantially as before set forth of a time lock mechanism, bolt 25 work, an eccentric operatively connected with the bolt work, a spring actuated train for moving said eccentric including a clutch, a clutch actuating lever, a concussion hammer and gearing connecting it with the eccentric 30 including a wheel loosely mounted on the eccentric shaft, a clutch for connecting and disconnecting said eccentric shaft and wheel, a controlling lever for both of said clutches and a trip for said controlling lever controlled by 35 the time mechanism.

84. The combination, substantially as before set forth of safe bolt work, an eccentric, a spring actuated gear train moving said eccentric including a clutch, a clutch retaining 40 lever.

85. The combination substantially as before set forth of a time lock mechanism its dog or hook and a day wheel, and a concussion 45 device for moving said day wheel.

86. The combination substantially as before set forth of a time lock mechanism, its dog or hook and a day wheel a concussion 50 hammer and gearing connecting it with said day wheel including a worm and worm wheel.

87. The combination substantially as before set forth of a spring barrel, a gear train including a fan regulator and a friction brake 55 combined with said regulator and controlled by said fan.

88. The combination, substantially as before set forth of a main spring barrel, a gear 60 train including a fan regulator, the sleeve inside of the fan hub, and rotating therewith, the spring connecting the fan shaft and sleeve, said sleeve having a screw threaded connection with the fan shaft, and the friction brake.

89. The combination, substantially as be-

fore set forth of a main spring barrel, a gear 65 train, a fan regulator connected with said gear train the sleeve, the spring connecting the fan shaft and sleeve within the fan hub and rotating therewith, a screw threaded connection between said sleeve and fan shaft and the pivoted 70 brake lever.

90. The combination, substantially as before set forth of safe bolt work, a concussion 75 hammer and a pawl, or pawls connected therewith, a revoluble shaft having a ratchet, a retaining pawl or pawls for the ratchet and a lever for disconnecting said hammer and retaining 80 pawls.

91. The combination, substantially as before set forth of safe bolt work, a concussion hammer having a pawl or pawls connected 85 therewith, a revoluble shaft, connected with said bolt work, having a ratchet and a retaining pawl or pawls, a lever for disconnecting said pawls having an incline, and a key for moving said shaft having an incline to en- 90 gage the incline of said lever.

92. The combination herein described of a 85 locking mechanism for safes, concussion devices and electrically controlled devices for moving parts of said mechanism whereby parts of the said locking mechanism can be 90 operated from the outside of the safe.

93. The combination, substantially as before set forth of locking mechanism for safes 95 concussion devices and electrically controlled devices for operating the same parts of the locking mechanism.

94. The combination with a duplex time 100 lock and its dog or hook, of a tripping mechanism for said dog or hook comprising two spring actuated notched arms, each adapted to engage a shaft of one of the time move- 105 ments, a mechanism for giving said notched arms a step-by-step movement including an intermittently moving part connected for movement with said arms, the springs of said 110 arms adapted to return the said part to its normal or original position unless each notched arm retains its engagement with the shaft of its time movement, and a concussion trip for the mechanism for actuating said arms.

95. The combination, as hereinbefore set 110 forth of a secure receptacle, locking mechanism located therein including concussion devices for moving parts of the same, and electrically controlled devices for actuating said 115 concussion devices.

In testimony whereof I affix my signature in presence of two witnesses.

MILTON A. DALTON.

Witnesses:

JOHN F. POGUE,
T. L. POGUE.