

G. W. HILL.
COMBINATION LOCK.

Patented Apr. 2, 1895.

[illegible]

This block contains four separate technical drawings, each labeled with a figure number.
Fig. 3. A cross-sectional view of a mechanical assembly. It features a central horizontal shaft with a component labeled 'A' on its left end. To the right of 'A' is a series of interlocking, stepped components labeled 'L', 'F', 'E', 'D', and 'C'. A vertical rod or pin, labeled '8' and '7', passes through the center of these components. On the far right, a vertical component labeled '4' is shown, with internal parts labeled 'C²D²', 'F²', and 'F²'.
Fig. 5. A cross-sectional view of a mechanical assembly, similar to Fig. 3. It shows a central horizontal shaft with a component labeled 'A' on its left end. To the right of 'A' is a series of interlocking, stepped components labeled 'L', 'F', 'E', 'D', and 'C'. A vertical rod or pin, labeled '8' and '7', passes through the center of these components. On the far right, a vertical component labeled '4' is shown, with internal parts labeled 'C²D²', 'F²', and 'F²'.
Fig. 7. A cross-sectional view of a mechanical assembly, similar to Fig. 3. It shows a central horizontal shaft with a component labeled 'A' on its left end. To the right of 'A' is a series of interlocking, stepped components labeled 'L', 'F', 'E', 'D', and 'C'. A vertical rod or pin, labeled '8' and '7', passes through the center of these components. On the far right, a vertical component labeled '4' is shown, with internal parts labeled 'C²D²', 'F²', and 'F²'.
Fig. 8. A cross-sectional view of a mechanical assembly, similar to Fig. 3. It shows a central horizontal shaft with a component labeled 'A' on its left end. To the right of 'A' is a series of interlocking, stepped components labeled 'L', 'F', 'E', 'D', and 'C'. A vertical rod or pin, labeled '8' and '7', passes through the center of these components. On the far right, a vertical component labeled '4' is shown, with internal parts labeled 'C²D²', 'F²', and 'F²'.

Fig. 1. A circular diagram, likely a compass rose or a celestial chart. It features concentric circles and radial lines. A central cross-like structure is shown, with labels H , I , and J indicating specific points or directions. The outermost circle is marked with four main directions: C^2 (top), D^2 (right), G^2 (bottom), and F^2 (left). The diagram is labeled "Fig. 1." in the top left corner.

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UNITED STATES PATENT OFFICE.

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COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 536,831, dated April 2, 1895.

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To all whom it may concern:

Be it known that I, GEORGE W. HILL, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and Territory of Utah, have invented certain new and useful Improvements in Combination-Locks; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in locks, and particularly to improvements in that class thereof known as combination locks, and it consists in an improved combination lock especially fitted for use in connection with safes and vaults, the construction and arrangement of the parts of which will be hereinafter fully described and particularly pointed out in the claims.

Heretofore combination locks, so far as I am aware, have almost uniformly made use of tumblers as a means for preventing the bolt from being withdrawn until the dial of the lock has been turned through the number of turns necessary to form the combination, the tumblers being in such connection with the bolt-cut-off mechanism that only when they are in a pre-determined position will the said mechanism assume such a position as will allow the bolt to be withdrawn. Combination locks constructed according to this plan have proved themselves to be of great value, and have gone into extensive use. It has been found, however, that there is one important disadvantage attendant to the use of these locks. When the dial of the lock is turned, there is a clicking sound produced as the operating arm strikes and moves the various tumblers, and the noise thus produced is sufficient to enable an expert to ascertain, by merely turning the dial, the proper combination to unlock the lock. This feature lessens the safety of combination locks constructed according to the present ideas, and while means are used to lessen, as far as possible, the clicking produced by the movement of the tumblers, the locks are thereby complicated, and the defect not entirely remedied. I am aware that there are a few instances in which combination locks have been constructed on other principles than that stated,

such, for instance, as the forming of a tortuous passage on the side of a disk, through which the locking pin is to run and reach a definite point before the unlocking of the lock can take place; but the locks constructed on these principles have not acquired any prominence, on account of defects peculiar to each particular lock.

The main object of my invention is to devise a combination lock in which the dial can be turned through the number of turns necessary to unlock the lock without causing the slightest noise. In this manner I overcome the chief objection which is found with the present combination locks.

Other objects of my invention are to simplify and render more compact the mechanism of the lock, so that the lock will be less liable to get out of order, and by virtue of its compactness can be less easily blown, and also to enable the combination of the lock to be changed more quickly and easily than is possible with the present locks.

In the lock by which I accomplish the objects of my invention, I entirely discard the use of tumblers, and use instead a cylinder, turned by the operative dial, and having formed on its periphery a number of grooves, running from side to side, and so related to each other that when the cylinder is turned in the proper manner, or through the turns necessary to arrive at the proper combination, a point traveling in such grooves will traverse the length of the cylinder, and will reach any pre-determined portion of the same. I provide a point for traveling in such grooves, and place such point in such connection with the bolt cut-off mechanism that when it reaches a pre-determined portion of the cylinder, the bolt cut off mechanism will be allowed to assume such a position as will permit the withdrawal of the bolt. A lock formed as thus described has but one combination.

To enable the combination of a lock to be changed, I use instead of a single cylinder, a number of independently revoluble cylindrical sections, grooved in the same manner as the cylinder, and provided with means whereby their respective positions can be indicated on a suitable dial. A change of combination can be effected by merely altering the positions of the various sections with relation to

each other. When the change of combination has been made, the sections are locked together, and turned by the operative dial as if they were of one piece. The grooves cut in the cylinder or cylindrical sections are of different lengths, and meet each other at different angles. At several points on the surface of the cylinder two or three of the grooves meet at a single point, so that only by knowing the exact combination can the point be properly guided, and made to reach the predetermined portion of the cylinder, which it must reach in order to be enabled to unlock the lock.

My invention is fully described in the drawings accompanying and forming a part of this application, in which the same reference letters or numerals refer to the same or corresponding parts, and in which—

Figure 1 is a perspective side view of my improved lock, showing the same in the case in which it is held. Fig. 2 is a top perspective view, looking in the direction opposite to that shown in Fig. 1. Fig. 3 is an enlarged section of Fig. 2 on the line $x x$, showing particularly the cylindrical sections, and the parts in immediate connection therewith. Fig. 4 is a view of the rear or setting dial. Fig. 5 is a detail view of the ratchet and pawl used to lock the operative dial when the lock is unlocked. Fig. 6 is a section of Fig. 1 taken on the line $y y$, showing the bolt and bolt cut-off block. Fig. 7 is a detail of the bolt cut-off block. Fig. 8 shows the lever, its pin normally held down by the spring and the guide foot 7.

Referring to the drawings, 1 indicates the case in which the lock is held, and 2 the safe wall or other wall to which the case 1 is secured. Between the sides 3 and 4 of the case is journaled the spindle A. This spindle extends through sides of the case 1. To the end which projects beyond the safe wall is keyed the dial B. Upon this spindle I mount the cylinder having a grooved periphery. In the construction shown in the drawings, this cylinder is divided into a number of sections to enable a change of combination to be effected. The cylindrical sections are C D E and F, and they are independently revoluble. Upon their peripheries are formed a number of grooves, running from right to left, and left to right, and meeting each other at different angles. At some points, as shown in Figs. 1 and 2, two or three of the grooves meet, and some of the grooves may be but branches of a main groove which return to said groove. The grooves are so related to each other that when the various cylindrical sections are turned in the proper direction, a continuous groove is formed from one side of the cylinder to the other, so that a point moving in said grooves can move from section F to section C, and moving in said section will finally be guided to the top groove formed therein. Integrally with each of these sections is formed a collar C', D', E' and F'.

These collars all extend in the same direction, and project from the side 4 of the case 1. The lengths of the projecting portions of the various collars differ, so that free movement is allowed for the indicating hands C², D², E² and F², one of which is attached to each collar. These hands indicate the positions of the various sections on the rear or setting dial G, and the combination once formed can be read at a glance. Change of combination can be effected very readily by merely changing the positions of the hands, and thereby the sections to which they are attached. To hold the sections fixed in position after the change has been effected, the fastener H is provided, which clamps down over the projecting collars C', D', E' and F', and is held in position by the screw I. A cover L is provided for the rear or setting dial to prevent accidental movement of the various sections.

In the grooves cut in the periphery in the cylindrical sections moves the guide foot 7, and this guide foot is in such connection with the bolt cut-off mechanism, that when it is moved through the turning of the dial so that it passes up into the highest groove in section C, the bolt cut-off mechanism is caused to assume a position which will permit the withdrawal of the bolt.

The connection between the guide foot 7 and the bolt cut-off mechanism is as follows:— Between the sides of the case 1 is secured the arbor 5, upon which is mounted the collar 6. To this collar is keyed the lever 8, through one end of which passes the pin 7', normally held down by the spring 7², and having keyed thereto or formed integrally therewith, the guide foot 7, which is provided with a keel 7³, and to the other end of which is attached the bolt cut-off block 9. The spring 10', which is attached to the collar 6 and to the side of the case, acts to hold the pin in engagement with the grooves of the cylinder. The bolt cut-off block 9 moves between the two blocks 10 and 11, and normally is held so that the aperture formed therein does not register with the apertures formed in said blocks 10 and 11, thus preventing the withdrawal of the bolt 12. On the bolt 12 is formed a collar 13, which limits its forward and back movement, and in said bolt is formed a slot 14, in which plays an arm 15 formed on the spindle 16, to one end of which is attached a handle 17. The arm 15 may fit tightly in the slot 14, or it may be allowed to play therein. In the drawings is shown a stop 18 to limit such play. The construction is such that when the bolt cut-off block 9 falls so that the aperture formed therein registers with the apertures 10 and 11, the turning of the handle 17 will cause the bolt to be withdrawn.

It is desirable to prevent any strain on the guide foot 7 when the bolt is withdrawn, and for this purpose means are provided for locking the cylindrical sections C, D, E and F. These means are as follows: On spindle A is mounted the ratchet L. One side of the ap-

erture in the ratchet through which the bolt passes is flat, as shown in Fig. 5, so that no movement of the ratchet on the spindle is possible. Below the ratchet wheel L, but normally held out of engagement therewith by the spring 19, is the pawl 20. Lengthwise of the case 1, and guided by suitable guides 21 is the lever 22. One end 23 of this lever is bent upward, and is slotted to permit the engagement therewith of the arm 24 formed on the axis 16. The other end of the same, when the lever is pushed backward, forces the pawl 20 into engagement with the ratchet L, thus effectually locking the ratchet, and the spindle on which it is mounted. When the lock is locked, the lever 22 is in its forward position, and the pawl 20 is free from engagement with the ratchet L. When the bolt 12 is withdrawn, however, the lever 22 is forced backward by the pin 24, and the pawl 20 locks the ratchet L.

The operation of my lock is as follows: Change in combination is effected by removing the cover K, loosening the fastener H, and setting the cylindrical sections C D E and F by a movement of their respective indicating hands. The fastener H is then placed in position, the cover K put on, the dial turned to the right in order to get the guide foot at the starting point, and the lock is ready for operation. When the dial B is now turned through the proper combination, the guide foot 7 will be guided through the grooves in the cylindrical sections, the keel keeping it in the proper groove when two or more grooves intersect, until it reaches the top groove in the section C. When in this position, the bolt cut-off block 9 is forced downward so that the bolt 12 can be withdrawn. The withdrawal of the bolt locks the cylindrical sections from moving by means of the pawl 20 engaging with the ratchet wheel L. When the bolt 12 is moved forward again by the turning of the handle 17, a turn of the dial B will destroy the combination.

It is evident that minor changes of construction can be made without departing from the scope and spirit of my invention.

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

1. In a lock, the combination with a bolt, a bolt cut-off mechanism, and an operative dial, of a cylinder moved by the movement of the dial, and having formed in its periphery a number of grooves, running in the same or different directions, but so related to each other that it is possible for a guide foot moving in said grooves to be guided to any predetermined portion of the cylinder, a guide foot moving in said grooves, and means for causing the bolt cut-off mechanism to assume such position as to allow the bolt to be withdrawn when the guide foot has reached a pre-

determined portion of the cylinder, substantially as described.

2. In a lock, the combination with a bolt, a bolt cut-off mechanism, and an operative dial, of independently revoluble cylindrical sections, mounted on the same axis and arranged to be keyed together to be moved as one piece by the movement of the dial, grooves formed in the peripheries of such sections running in the same or opposite directions, but so related to each other that it is possible for a guide foot moving in said grooves to be guided to any pre-determined portion of said cylinder, a guide foot moving in said grooves, and means for causing the bolt cut-off mechanism to assume such position to allow the bolt to be withdrawn when the guide foot has reached a predetermined portion of the cylinder, substantially as described.

3. In a lock, the combination with a bolt, a bolt cut-off mechanism, and an operative dial, of independently revoluble cylindrical sections, mounted on the same axis and arranged to be keyed together to be moved by the movement of the dial, a setting dial, and means for indicating thereon the positions of the cylindrical sections, grooves formed in the peripheries of such sections running in the same or opposite directions, but so related to each other that it is possible for a guide foot moving in said grooves to be guided to any predetermined portion of said cylinder, a guide foot moving in said grooves, and means for causing the bolt cut-off mechanism to assume such a position as to allow the bolt to be withdrawn when the guide foot has reached a predetermined portion of the cylinder, substantially as described.

4. In a lock, the combination with a bolt, a bolt cut-off mechanism, and an operative dial, of independently revoluble sections, mounted on a common axis, and arranged to be keyed together so as to be moved by a movement of the dial, a setting dial, collars integrally formed with said cylindrical sections and bearing indicating hands for indicating the respective positions of their sections on the setting dial, grooves formed in the peripheries of the sections running in the same or opposite directions, but so related to each other that it is possible for a guide foot moving in said grooves to be guided to any predetermined portion on said cylinder, a guide foot moving in said grooves, and means for causing the bolt cut-off mechanism to assume such a position as to allow the bolt to be withdrawn when the guide foot has reached a predetermined portion of the cylinder, substantially as described.

5. In a lock, the combination with a bolt and a bolt cut-off mechanism, of a cylinder moved by the movement of the dial and having formed in its periphery a number of

grooves, running in the same or different directions, but so related to each other that it is possible for a guide foot moving in said grooves to be guided to any predetermined portion of the cylinder, a guide foot moving in said grooves, means for causing the bolt to be withdrawn when the guide foot has reached a predetermined portion of the cylinder, and means for locking the cylinder when the bolt is withdrawn, substantially as described. 10

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

GEORGE W. HILL.

Witnesses:

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