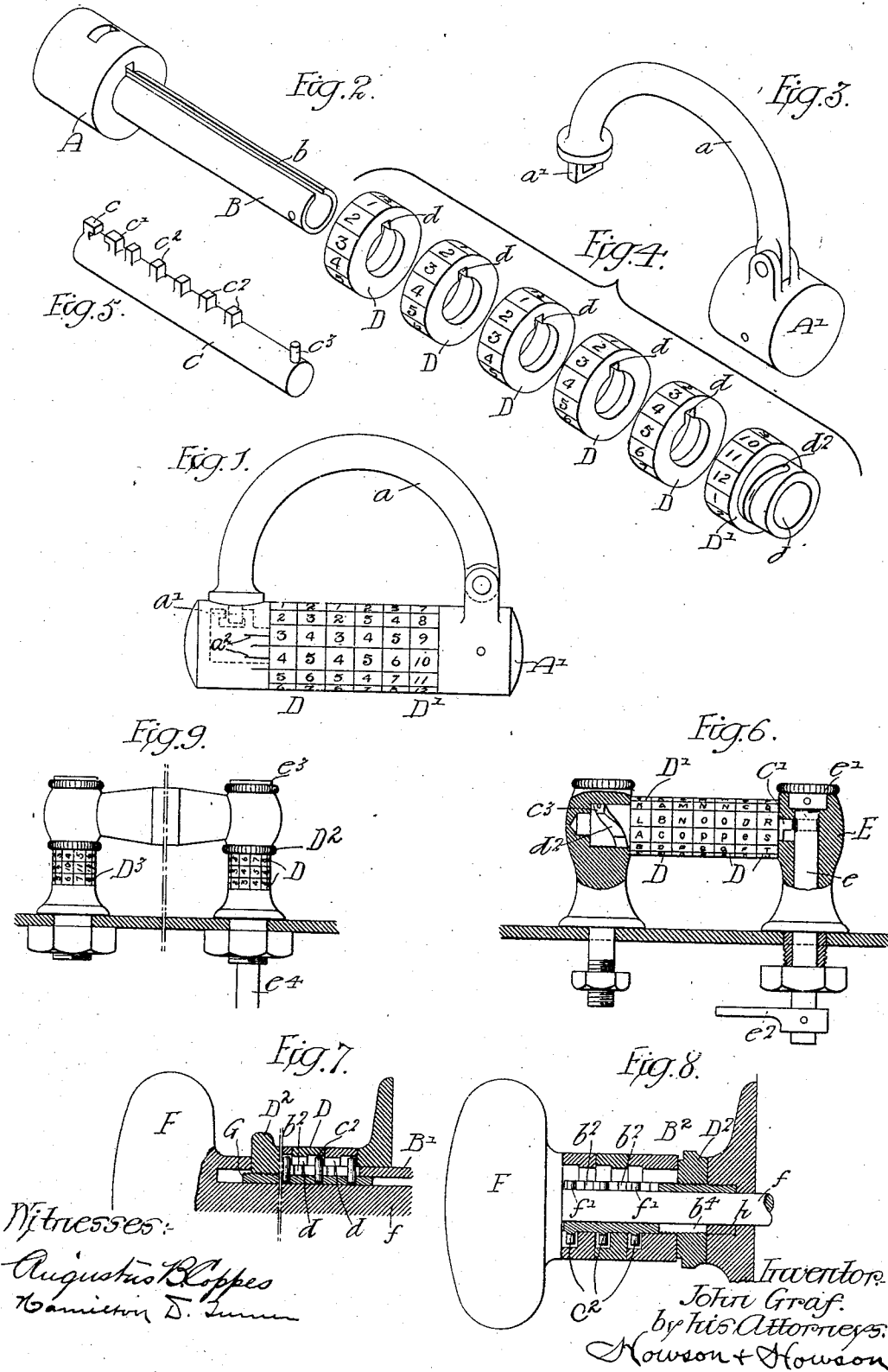


J. GRAF.
 COMBINATION LOCK.
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COMBINATION-LOCK.

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To all whom it may concern:

Be it known that I, JOHN GRAF, a citizen of the Republic of Switzerland, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Combination-Locks, of which the following is a specification.

One object of my invention is to provide a form of combination-lock having such an arrangement of parts as will render its opening practically impossible unless the person operating the same has knowledge not only of the necessary combination of figures or letters, but also operates the various parts in a certain predetermined order and manner.

It is further desired to provide a combination-lock of such a nature that in order to successfully open it it shall be necessary, in addition to bringing certain symbols upon a number of revoluble rings into a predetermined line and opposite a given fixed mark, that a certain other ring be turned for a definite distance in a definite direction after the first-mentioned rings have been operated.

These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of one form of my improved lock. Fig. 2 is a perspective view of one end of the lock, showing the slotted cylinder fixed to the same. Fig. 3 is a perspective view of the second or hasp-carrying end of the lock. Fig. 4 includes detached perspective views of the various rings employed in my lock. Fig. 5 is a perspective view of the bolt employed in that form of lock shown in Fig. 1. Fig. 6 is a sectional elevation of a special form of my invention. Figs. 7 and 8 are sectional elevations of forms of my improved lock, showing it as applied to the spindle of a door-knob; and Fig. 9 is a slightly-modified form of the lock shown in Fig. 6.

Referring to Figs. 1 to 5 of the above drawings, it will be seen that the frame or body of the lock is formed by two cylindrical end pieces A and A', joined and rigidly held together by a longitudinally-slotted tube B, which forms part of or is permanently fastened into one of said parts, as A, and is pinned, or, if desired, soldered, into the second of said parts A'. Hinged to this latter part in the well-known manner is a shackle a, whose free end a' is adapted to enter the opening in the end piece A of the lock.

A bolt C is provided within the tube B, and there are at one end of said bolt two hooked

projections or pins c and c', having their overhanging portions extended toward each other, but separated by a space sufficiently wide to permit passage of the slotted end a' of the shackle a when said bolt is in proper position. There also projects from the bolt a series of teeth or pins c² of sufficient length to extend through and beyond the slot b of the tube B. Revolvably supported upon this tube and preferably of the same outside diameter as the two end pieces A and A' are a series of rings D, having flanged portions, as shown, which form with said end pieces and with an additional ring D' a substantially cylindrical surface.

The opening through each ring D is practically of the same diameter as the outside diameter of the tube B, and each ring has in it a slot d to permit of the passage of one of the pins c on the bolt C. The ring D' has a tubular extension d', which projects into the end piece A' and is provided with a helical slot d². Upon the bolt C is a pin c³, in addition to those above noted, which enters the slot d², so that revolution of the ring D' upon the tube B causes said bolt C to be moved longitudinally.

The surface of each of the rings D and D' is divided into a number of sections by lines or indentations parallel with the axis of the bolt, which are numbered or lettered, as desired, there being also one or more indicating-marks a² upon one of the ends or fixed portions of the lock.

When the device is assembled, it has the appearance indicated in Fig. 1, it being noted that the various figures or numbers upon the rings and the lines between them bear a definite relation to the slots d.

In order that the shackle a may be released, it is necessary to bring the slots d in the rings D in line with the pins c² of the bolt C, this being done by bringing certain of the lines adjacent to a predetermined combination of numbers on the rings in line with one of the lines a² on the end piece A. When this condition exists, it is possible to rotate the ring D', and thereby cause the helical slot d² to operate upon the pin c³, so as to longitudinally move the bolt C, said motion being rendered possible by reason of the fact that all of the slots d are in the line of motion of the pins c², which may therefore move into or through them. The ring D' must be turned through a predetermined distance, so that the end a' of the shackle a is between the overhanging

or hooked ends of both of the pins c and c' , since it will be seen that if the bolt C be moved by the ring D' too far or not far enough the end of the shackle a will not be released.

When the lock is in its closed position, all of the rings D are free to rotate, though the ring D' is held stationary by reason of the fact that the bolt C is prevented from moving longitudinally by one or more of said rings D. It will hence be noted that the ring D' can only be moved when all of the slots d are in line with the pins c^2 , which condition cannot exist until after the various rings D have been so moved as to give the predetermined combination in line with one of the marks a^2 upon the end piece A.

In Fig. 6 I have shown the device as applied to the transverse portion of a drawer-handle. In this case one of the arms E of the handle is made tubular and provided with a spindle e , to the outer end of which is fastened a milled head e' , while its inner end carries a latch or lock lever e^2 of any desired form. When said latch or lever occupies its locked position, the spindle e is held from turning by means of a longitudinally-movable bolt C', and the end of this bolt is moved into or out of an opening through the spindle e by revolution of the ring D'. This ring, as before, is provided with a helical slot d^2 for the reception of a pin c^3 on the bolt, and, as before described, it is necessary that all of the various rings D shall be brought into a predetermined position before it is possible to revolve the ring D'. When the bolt C' has been moved out of engagement with the spindle e , this latter may be freely turned by means of its milled head e' and the latch or lever e^2 operated accordingly.

In Fig. 7 I have shown my invention as applied to the spindle and handle of a door-knob designed to actuate a latch in the well-known manner when the spindle f is turned. Ordinarily it is not possible to rotate the spindle f by means of the knob F because of the longitudinally-slotted tube B', which is immovably held to the door in any suitable manner. This tube fits over the outside of a second tube G, in which the pins c^2 are fastened, while the tube G in turn fits over the square spindle f , so that it is compelled to turn with said spindle, but is free to slide longitudinally thereon. The tube B', in addition to its longitudinal slot, through which the pins c^2 project, is provided with a series of transverse slots whose ends are shown at b^2 , being spaced the same distance apart as said pins and of such dimensions that the latter are free to move in them. The tube G may be moved longitudinally by means of a ring D², which is threaded upon it, as shown in Fig. 7, while, as before noted, there are a series of radially-slotted rings D, which prevent longitudinal movement of the said tube G unless their slots

are in line so as to permit passage of the pins c^2 .

In order to permit turning of the knob F, the various rings D, whose surfaces are divided off and numbered as shown in the figures, are turned until a predetermined combination is formed, at which time all of the slots d are in line with the line of the pins c^2 . When this condition exists, it is then possible to move the tube G upon the spindle f by turning the ring D² through a predetermined number of revolutions or portions thereof until the various pins c^2 are opposite their respective transverse slots b^2 in the tube B', which, as before noted, is permanently and rigidly fixed to the door to which the device is attached. When the pins c^2 have been brought opposite the slots b^2 , the knob F may be turned and with it the spindle f , thereby operating the latch or lock on said spindle.

In that form of the device shown in Fig. 8 there is but a single sleeve or tube B² upon the knob-spindle f' , which in place of being square is provided with pins f' . As in the case of the tube B' this tube B² has a longitudinal slot and transverse slots for the reception of these pins, while it carries in addition pins c^2 , which, as in the other forms of my invention, coact with the rings D. After these latter have been brought to their predetermined positions it is possible to move the sleeve B² by properly turning the ring D² threaded thereon. When said ring has been moved a sufficient distance to bring the pins f' in the same planes as their respective slots b^2 , then only is it possible to turn the knob F, and thereby operate the latch or lock connected to the spindle f . While I have shown the sleeve B² as provided with a keyway b^1 coacting with a projection or key h on the scutcheon, other means may be provided for preventing revolution of said sleeve while leaving it free to move longitudinally. This same combination of parts may be applied to a drawer-handle, as shown in Fig. 9, so that it is only possible to turn the milled head e^3 after the rings D have been brought into predetermined positions and the ring D² turned through a predetermined angle or any definite number of revolutions. If desired, a second set of rings D³ may be applied to the second standard of the handle, these being, however, dummies and serving to confuse any person attempting to operate the lock without knowledge of the construction as well as of the combination thereof. As in the case of the device shown in Fig. 6, any desired form of latch or lock lever may be operated from the spindle e^4 .

I claim as my invention—

1. A combination-lock including a fixed portion, a longitudinally-movable bolt having projecting pins, a series of revoluble rings, certain of which have slots to permit passage of the pins, means for connecting the bolt

with one of said rings so that revolution of said ring moves the bolt longitudinally, and a member constructed to be held in a locked position by the bolt, substantially as described.

2. A combination-lock including a relatively fixed portion, a longitudinally-movable bolt having projecting pins, a series of revoluble rings having radial slots placed to permit passage of the pins when in predetermined positions, a revoluble ring having a pin-and-slot connection with the bolt for moving the same, and a member constructed to be held in a locked position by the bolt, substantially as described.

3. A combination-lock including a relatively fixed portion having a slotted sleeve, a bolt for said sleeve provided with pins projecting through the slot in the sleeve, a series of revoluble rings, each having a radial slot placed to permit of the longitudinal movement of one of the pins, a device for moving the bolt when said rings are in predetermined positions, and a member normally in a locked condition constructed to be released when the bolt has been moved to a predetermined position, substantially as described.

4. A combination-lock including two end pieces having a longitudinally-slotted sleeve rigidly connecting them, a shackle hinged to one of said end pieces and constructed to enter an opening in the other, a bolt in the sleeve constructed to engage the end of the shackle to hold the same in a locked position, a series of pins on the bolt projecting through the slot in the sleeve, a series of rings on the sleeve each having a radial slot to permit of the passage of a pin, with a piece having means for moving the bolt longitudinally, substantially as described.

5. A combination-lock including two end pieces and a longitudinally-slotted sleeve rigidly connecting the same, a shackle connected to one of said end pieces and constructed to enter the opening in the other, a bolt in the sleeve having a series of pins projecting through the slot thereof, a series of rings on the sleeve, of which certain have radial slots permitting passage of the pins and another has a pin-and-slot connection with the bolt for

moving the same longitudinally when the radial slots of the other rings are in the line of motion of their respective pins on the bolt, substantially as described.

6. A combination-lock including two end pieces and a longitudinally-slotted sleeve rigidly connecting the same, a shackle connected to one of said end pieces and constructed to enter the opening in the other, a bolt in the sleeve having a series of pins projecting through the slot thereof, a series of rings on the sleeve, of which certain have radial slots for permitting passage of the pins, and another has a pin-and-slot connection with the bolt for moving the same longitudinally when the radial slots of the other rings are in the line of motion of their respective pins, said bolt having also two hooked projections for engagement with the slotted end of the shackle, substantially as described.

7. A combination-lock including two end sections and a longitudinally-slotted piece rigidly connecting the same, there being an indicating mark or marks on one of said end pieces, a shackle hinged to one end piece, said shackle having its free end slotted and constructed to enter an opening in the other end piece, a longitudinally-movable bolt having projecting pins and provided with a portion for engaging the end of the shackle, a series of revoluble rings provided with radial slots shaped to permit passage of the pins on the bolt, a revoluble piece, and a pin-and-slot connection between said piece and the bolt for moving the latter longitudinally, each of said rings having an indicating-mark and being constructed to permit of movement of the bolt by said revoluble piece only when said marks occupy predetermined positions relatively to the mark or marks upon the end piece of the lock, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN GRAF.

Witnesses:

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JOS. H. KLEIN.