

D.W. Mayles,

2 Sheets-Sheet 1.

Permutation Lock.

No 3,842.

Patented Dec. 4, 1844.

Fig. A

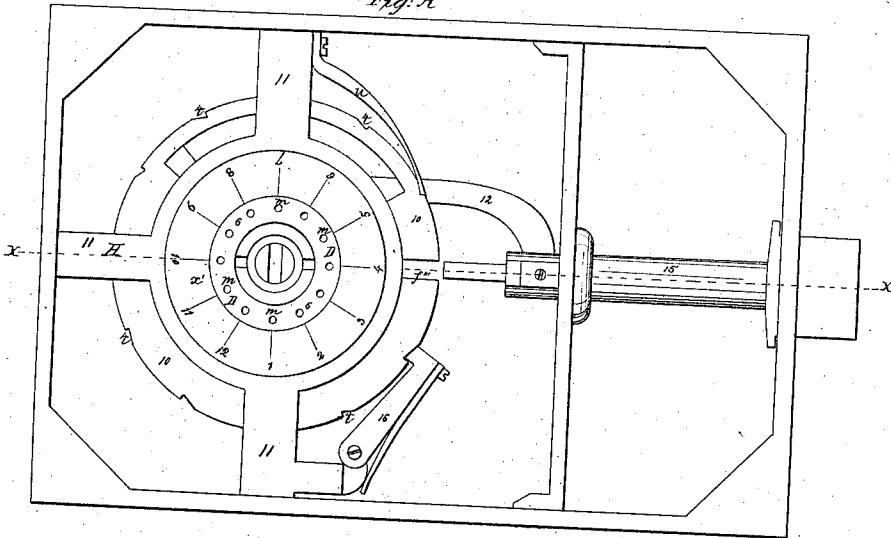


Fig. B

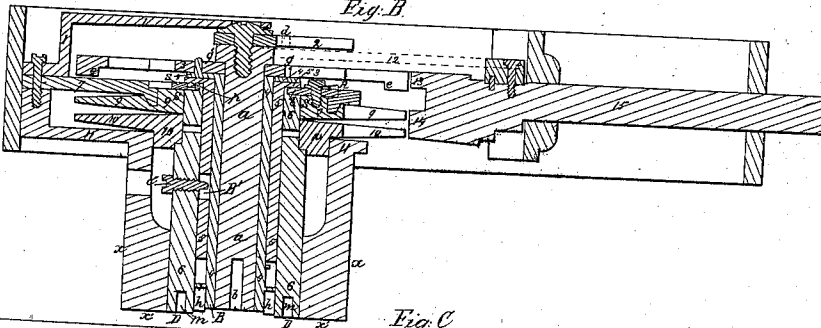
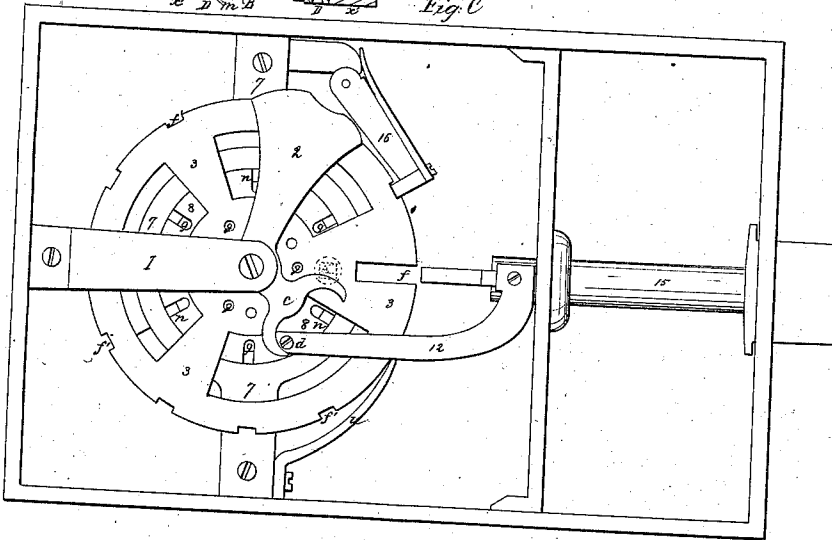


Fig. C

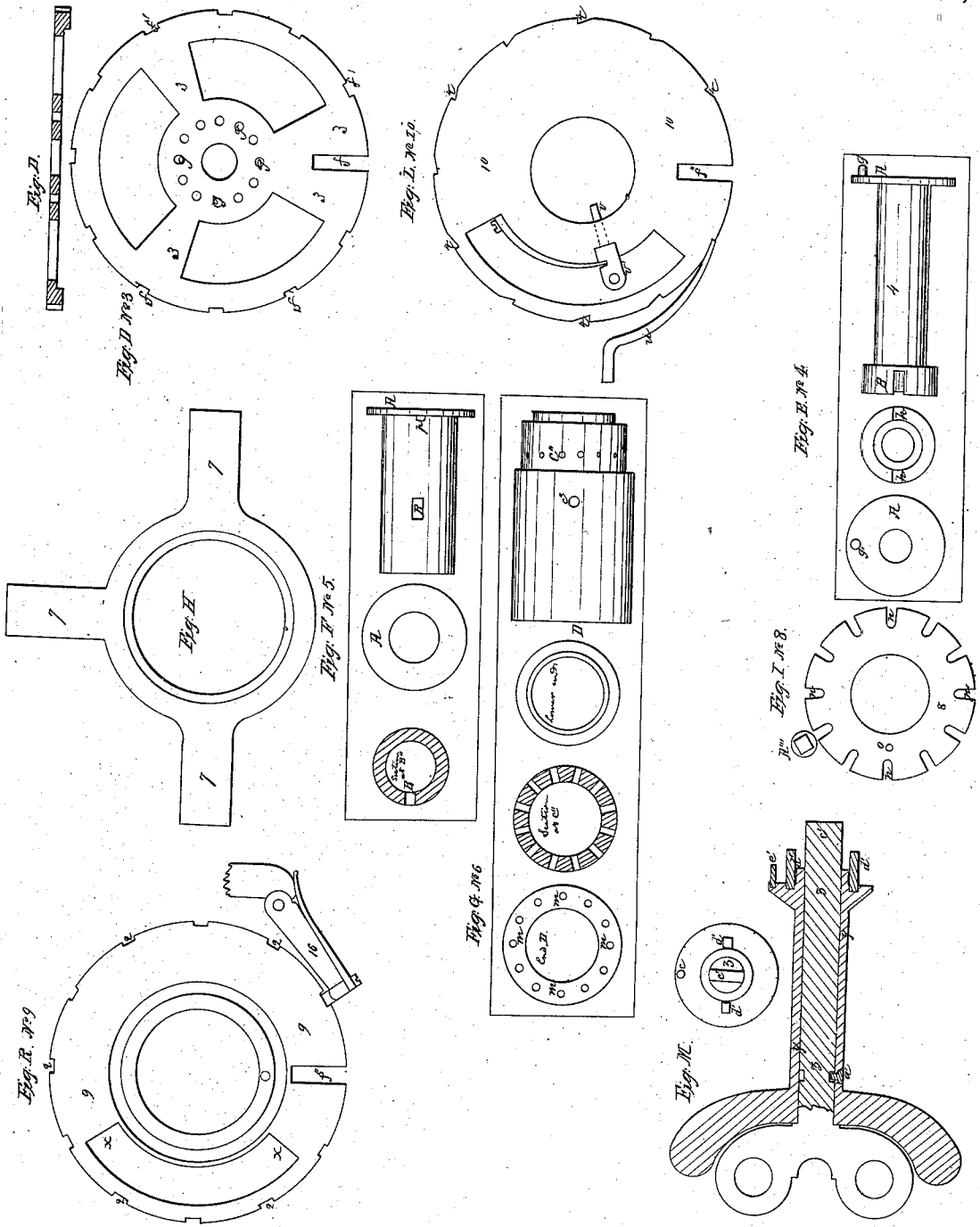


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# UNITED STATES PATENT OFFICE.

DARIUS W. MAPLES, OF GENEVA, NEW YORK.

PERMUTATION-LOCK FOR VAULTS, SAFES, &c.

Specification of Letters Patent No. 3,842, dated December 4, 1844.

*To all whom it may concern:*

Be it known that I, DARIUS W. MAPLES, of Geneva, in the county of Ontario and State of New York, have invented an improved permutation-lock which is adapted to securely fastening of the doors of vaults, safes, chests, and all other structures where special security is required; and I do hereby declare that the following is a full and exact description thereof.

The leading feature of this lock is the application of several concentric wheels or plates parallel to the surface of the lock, in each of which there is cut a slot or chace for the tail of the bolt to play in, and the diameters of which are such that when the bolt is thrown out or "locked" and the slots turned partly round or "shut" the peripheries of these wheels abut against the tail of the bolt and prevent it from being forced in or "unlocked." By means of certain mechanical contrivances these wheels are so related to each other that they cannot all be "open" at the same time unless a certain series of positions shall have been given to them successively; that is to say, unless each one, in its proper turn be placed in a certain relative position with regard to the others and all in a certain absolute position in the lock. These series or combinations of relative positions may be varied at pleasure and as there is a determinate number of positions for each wheel, there is a chance, depending on the number of wheels and the number of positions assumable by each; and as this chance depends on the principles of permutation, this invention is denominated a permutation lock.

The number of positions or "rests" as well as the number of wheels, depending on the will of the maker, I shall in what follows confine myself to the description of a large sized three wheeled lock already constructed, and for the purpose of description shall refer to the annexed drawings, in which—

Figure A, is a front elevation of the machinery of the lock, the outer plate or cover of the box being removed for the purpose of showing the interior. Fig. B, is a longitudinal section, in the line  $x x$  of Fig. A, the face or front of the lock being downward. Fig. C, a back elevation, when the lock is inverted so as to bring the bolt on the same side as in Fig. A.

In the section Fig. B, the connection of

the different parts is shown, which parts are numbered and lettered alike in each of the figures. No. 1, is a back spring of steel—the plan of which is shown in Fig. C, and the use of which is to maintain or restore the connection between the parts numbered 5 and 8, as will be more particularly noticed hereafter.

No. 2 is the driver by means of which the bolt is to be moved back and forth; the cylindrical stem  $a, a$ , of the driver, and the slot  $b$ , for admitting the center tongue  $c'$ , of the key, Fig. M, are clearly shown in the section, while the plan Fig. C, shows its two arms No. 2 and  $c$ , nearly at right angles to each other and parallel to the wheels; one of these arms numbered 2 (which is single) acts against the shank of the tumbler No. 16, when it is required to free the wheel No. 9. The other arm  $c$ , which is double pointed, acts against a stud  $d$ , in the spanner No. 12 and thereby urges the bolt out or in, the spanner being firmly attached to said bolt.

No. 3, is the "back wheel" this is shown in detail in Figs. D and D' which latter is a section of it. It is represented as an open-worked wheel made thickest at the rim as shown at  $e, e$ , and also in Fig. B. There is in it a slot  $f$ , for the bolt; eleven notches  $f' f'$ , on its periphery, and a circular row of 12 holes  $g, g$ , fitted to receive a stud as at  $g'$ , projecting from the flange of the part marked No. 4 Fig. B, by which the number, position or permutation of this wheel is regulated; this wheel as well as the others, is concentric with the stem of the driver, around which it moves freely. No. 4 has a hollow port or tube, turning around the stem of the driver, and shown in detail at Fig. E, the flange A' at its top has a small stud  $g'$  which fits the holes  $g$ , in No. 3, and carries Nos. 3 and 4 round together. The front end B' of this piece No. 4 is even with the stem  $a, a$ , of the driver; it has two slots  $h, h$ , for the purpose of introducing the two bits  $d' d'$  of the key, Fig. M. The end B' is enlarged by a flange surrounding it, which strengthens it to receive the bits  $d', d'$ , and serves also to fill a partial vacancy which would otherwise be caused by the shortness of the part numbered 5. The part No. 5 is also tubular and fits upon No. 4. No. 5 has a flange with a stud projecting downward. Its tubular part is shorter than that of No. 4, and it has an independ-

ent rotary motion. A small pin shown at  $p$ , in Fig. B, communicates to it the motion of No. 4 whenever it is pressed into the plate S, which serves to connect 3, 5 and 6, as will presently appear, and as is represented in Fig. B, and another working in a slot in its cylindrical stem, shown at B'', Fig. F, communicates the motion of the next wheel, No. 6, when it is turned around. The details of this piece are given in Fig. F, where the flange A'', the stud  $p$ , and the slot B'' into which enters a screw  $c''$  Fig. B, are distinctly represented. No. 6, is also a hollow tube or socket fitting upon No. 5 which it carries around by means of the pin or screw  $c''$  playing in the slot B'' just described and shown in Fig. B. The thickness of this screw or pin is just equal to the width of the slot, allowing No. 5 to slide lengthwise in No. 6, but not to turn in it. The details of this piece are given in Fig. G, where are shown 12 holes  $m, m$ , in the end D, to receive the pin, or bit,  $e'$ , Fig. M, of the key; these holes are seen also in Fig. A. The end D, of this piece is flush, or nearly so, with the stem of the driver  $a, a$ , and with the index  $x, x$ .

$c''$  is the place of the screw which is received in the slot B'' of No. 5—Fig. F. There are in the cylindrical stem of No. 6, 12 other holes  $c''$ , by means of which and the spring pin shown in Fig. L, (to be presently described) No. 6 is connected with No. 10, and turns it around the common center.

No. 7 is a part of the solid frame-work of the machinery which is firmly secured to the outer frame, and is separately represented in Fig. H.

No. 8, Figs. B and C, is a thin piece or plate of steel or other metal shown in plan in Fig. I, which plate serves to connect Nos. 3, 5 and 6 with Nos. 9 and 10, to be presently described, when such connection is necessary. This piece has 12 change slots  $n, n$ , some one of which embraces the head of the change pin A''' running into No. 9, and connecting the plate No. 8 with No. 9, so that one of them cannot turn without the other; there is in No. 8 also a hole  $o$ , to receive the stud  $p$  which projects from the flange of No. 5 so that Nos. 3, 4, 5, 6, 8, 9, 10, may be all made to revolve together when Nos. 5 and 8 are connected as will be more particularly described hereafter. The change pin A''' which screws into No. 9, may be placed in any one of the 12 slots  $n, n$ , in No. 8, and will give as many relative positions to the wheel 9.

No. 9 which is the middle wheel is represented in detail in Fig. K, where are shown 11 change notches  $q, q$ , and a spring tumbler No. 16, to retain this wheel in any certain positions determined by these notches, while the other wheels are in motion;  $x, x$ , is an

open space, cut out of this wheel for convenience in setting the spring pin hereinafter described, as connecting Nos. 6 and 10 and to be more particularly described;  $r$ , is a hole to admit the change pin A''', shown in figure B; this middle wheel as well as the front wheel is represented as having a large central "boss"  $s, s$ , and reduced in thickness toward the periphery. The arm Q, of the driver is long enough to engage with the shank of the tumbler 16, by which the nip of said tumbler is thrown out of the notches  $q$ , so as to give the wheel free play. The general details are fully represented in the drawings; and there is but one particular point to be noticed, viz, the wheel must be susceptible of being "stopped" fair for the shank of the bolt to pass into the slot  $f''$ , made in No. 9, for that purpose. No. 10 is the front wheel and is detailed in Fig. L, where are shown 11 stop teeth, or ratchets,  $t, t$ , and a spring  $u$ , permitting a motion from left to right, and also a spring pin  $v$ , with its spring  $w$ , which is used for connecting Nos. 6 and 10. This pin passes through the plane of No. 10, and makes the change, by being placed in the proper one of the 12 change pin holes C'' mentioned in the description of No. 6. This wheel No. 10 like the middle one can be placed so that the chase or slot  $f'''$  is fair for the bolt, or "open." The head  $v'$  of the bolt  $v$ , serves as a means of shifting it through the slot  $x x$  of No. 9. No. 11, is a part of the frame work of the machinery corresponding to No. 7, and shown in detail in Figs. A and B. The boss  $x, x$ , of this frame projects beyond the face of the lock, forming an escutcheon, which is graduated into 12 divisions as shown in Fig. A. The frame work Nos. 7 and 11 confine and steady all the parts and act as journal boxes for the outer hollow center and the bosses of the front and middle wheels. No. 12 is a spanner attached to the bolt as shown at Fig. C, and bearing a stud  $d$ , which engages with the points of the lower arm  $e$ , of the driver, and work the bolt backward and forward.

Nos. 13 and 14 are two branches into which the tail of the bolt 15 is divided. They correspond with the slots  $f f$ , of the wheels and the interval between them is sufficient to admit the frame piece No. 7. The key which is compound in its structure is shown in section in Fig. M, its stem Z, Z, is cylindrical, except at the lower end where it is flattened into a tongue or lip C', fitting the slot in the stem of the driver  $a, a$ , and calculated to turn the driver for the purpose of throwing the tumbler out of gear with the wheel No. 9, and to play the bolt out and in.

The barrel  $y, y$ , of the key fits upon the stem Z, Z, and is kept from working up and down by a pin  $a'$  which plays in a groove turned in the stem and shown in the section.

This barrel is cylindrical and has an enlargement at the extremity which is beveled and graduated to correspond with the graduation of the escutcheon; it has also three bits, two to fit in the slots No. 4 and one to fit in any one of the holes in No. 6, as represented and described. The handles of the key are made to fancy.

The Fig. M, shows a convenient way of arranging the parts of the key, but any other will answer provided a free play is left for the respective parts composing it. The back plate of the lock is so connected with the rim as to be easily removed so as to allow of changing the pins and combinations.

From the description and drawings it will be seen that the revolving parts of this lock are a driver, three wheels, three hollow centers, and a change plate; that these are concentric and movable by the tongues or bits of the key.

In Fig. B, Nos. 2, 3, 4, 5, are shown as forced up against the spring No. 1, so as to disengage No. 5 from the change plate No. 8. This position will not be maintained unless the key is pressed against the shoulder in No. 4; when the key is withdrawn the spring No. 1 will press the parts down again and the stud of No. 5 will either bear on the surface of No. 8, or fall into the hole of No. 8, if the stud rests upon the surface, or if the pressure upon the key is maintained, in either case the wheel No. 3 may be moved separately by fitting the bit of the key to the slots in part No. 4; the bit of the key cannot be put into the holes of No. 6 without also being in the slots of No. 4, because the bits of the key that enter No. 4 are longer than the one that enters into No. 6; No. 6, therefore cannot be turned alone, but always carries No. 4 with it, while No. 4 can be turned separately as before described. The front wheel No. 10 as before said is connected with No. 6 by the change pin and turns with it; inasmuch then as No. 6 cannot turn without No. 4, and the front and the back wheels also go with them, it follows that the front wheel cannot be turned without also turning the back wheel. The middle wheel when it moves is turned by the stud in No. 5, and as No. 5 cannot turn but with No. 6 the middle wheel also cannot move alone but must be turned with the front wheel.

It has just been shown that whenever the front wheel turns, the back one will do so likewise; and I will now show that when the middle wheel turns the front one must turn also, and consequently that when the middle wheel turns all three must likewise turn. There are then three sets of motions. First, when the tumbler is "up" so as to free the middle wheel, then all three may be moved together by putting the bit into any of the holes in No. 6. Secondly, when

the tumbler is "down" and the middle wheel is fast the key can be forced in so as to disengage the middle wheel, and then the front and back wheels can be moved together, still keeping the bit in No. 6. Thirdly, the ratchet spring prevents the front wheel from moving against the sun and if the bit be placed into the slot of No. 4, while the middle wheel is disengaged the back wheel can be turned alone against the sun, or even with the sun were it not for friction. These three motions amount to a separate motion for each wheel, and the process of unlocking will be as follows: First, put the "bit" into any of the holes of No. 6 and turning the inner post or stem of the key throw off the driver so as to be sure that the middle wheel is engaged with the tumbler. Then if Nos. 5 and 8 are engaged the whole will be solid; to ascertain this try the outer part or barrel, of the key; if it turns it will carry round the front and back wheels and the three center posts till the stud of No. 5 falls into the hole  $\phi$ , of No. 8. They will then all be fast and immovable. Secondly, then throw out the tumbler by turning the stem of the key and free the middle wheel. Thirdly, then with the outer part of the key turn all three wheels together till the slot of the middle wheel is fair for the bolt. Fourthly, then throw off the driver and let the tumbler spring down and fasten the middle wheel. Fifthly, press the key in with so much strength as to force up the back spring and turn the key a little, so as to disengage Nos. 5 and 8, and let the stud of No. 5 rest on the plate No. 8. Sixthly, now turn the front and back wheels together till the slot in the front wheel is fair for the bolt. Eighthly, now turn the of the key out of the post No. 6, and turn No. 4 alone the contrary way till the slot is fair for the bolt. Eighthly, now turn the stem of the key and driver, and throw back or unlock the bolt.

Fig. A, shows the escutcheon  $x'$ ,  $x'$ , graduated into 12 equal parts corresponding with the slots, ratchets, notches and stud-holes in the three wheels when they are all open or fair for the bolt. The outer centerpost, (No. 6) as has been said, is connected with the middle wheel by the plate (No. 8) and the stud of No. 5.

The pin hole in the wheel is opposite the slot for the bolt, and the distance or number of the graduated spaces between the slot, and the stud of No. 5 depends upon the particular change slot in which the change pin is placed; because the stud must be in the hole, and if the plate No. 8 is turned and the pin put into a different change slot the hole is necessarily either brought toward the slot or carried away from it. The number of spaces between the change pin and the stud hole is the number for this wheel. For

instance if there are five change slots (counting in the direction of the numbers) between the change pin and the stud hole then when this wheel is engaged its slot can always be put open, or fair, for the bolt by setting No. 1, of the hollow post No. 6, opposite No. 5 of the escutcheon. The front wheel as before said is connected with No. 6, by a change pin but this pin is two spaces behind the slot and consequently the number for this wheel is less by two than the number of the pin holes in No. 6; these pin holes being numbered the same as the corresponding graduations or holes of No. 6. For instance if the pin is in the hole No. 6 then there are 4 spaces between the slot in the wheel and No. 1, of the center post, and of consequence when No. 1 of the center post is at No. 4 of the escutcheon the slot will be open or fair for the bolt. The numbers of the two first wheels are thus set by first bringing No. 1 of the outer center post opposite the number of the middle wheel on the escutcheon and disengaging the middle wheel, and then setting No. 1 of the outer center post at the mark 10 of the escutcheon, which is proper for the front wheel; after this the outer center post remains fixed, and the number of the back wheel being set by the inner post, the stud upon the flange of No. 4 can be placed in any one of the 12 holes in the back wheel by loosening the back spring and raising the wheel. This stud is opposite to No. 1 of No. 4, and the number of the hole in which the stud is placed is the number of this wheel upon the escutcheon.

It is necessary in introducing the round bit of the key into No. 6, to be particular in noting which hole the bit enters when the bolt is thrown forward, because the bit must enter the same hole with any known permutation when it is unlocked as when it was locked. If not thus particular, there will be a chance of making twelve trials before

the bolt can be thrown back. But this relates only to the introducing of the key, as it forms no part of the permutations of the lock, but only removes the chance of making 12 trials. A mark may be placed on any one of the holes by the owner of the lock, by which he can easily find any number from one to twelve, inclusive.

Having thus fully described the nature of my improved permutation lock, and shown the manner in which the same operates, what I claim as new therein, and desire to secure by Letters Patent is—

The manner herein set forth in which I have arranged and combined the hollow centers with their wheels and their other appendages, so constructed as to receive the change pin A''' through slots in a plate operating like No. 8, and also to receive a set pin operating like that marked v, in the accompanying drawings; these pins and the other parts described being so arranged as that by the said combination of parts the said lock may be set by their means, and by that of the graduations on the escutcheon, and may be locked and unlocked by the application of a compound key, such as is herein described; the lock being operated upon by three sets of motions, as set forth. The combination and arrangement as a whole being substantially such as is herein fully made known; not intending, however, to limit myself by this claim to the precise number of divisions, or other parts which govern the extent of the different permutations which may be made by means of a lock constructed upon this principle, but to vary these to any extent which I may deem proper while the arrangement of the instrument is such as to preserve the same principle of action, and the same combination of parts.

D. W. MAPLES.

Witnesses:

HENRY DWIGHT,  
JOHN N. JOHNSTON.