

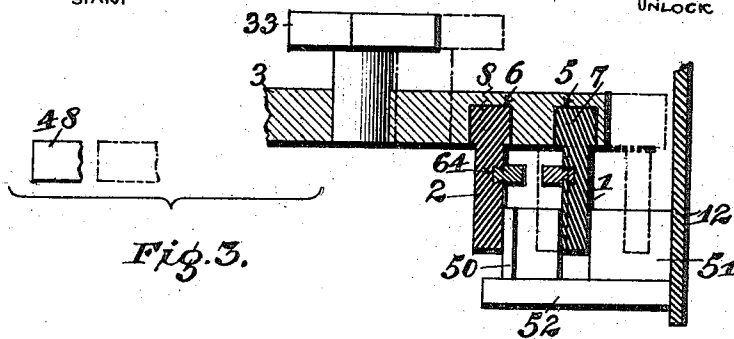
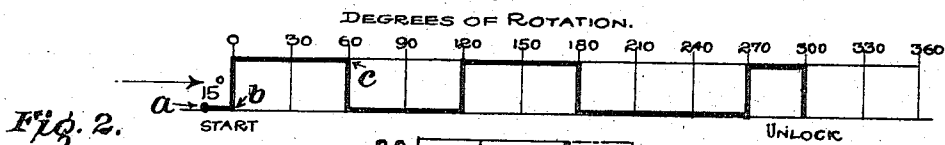
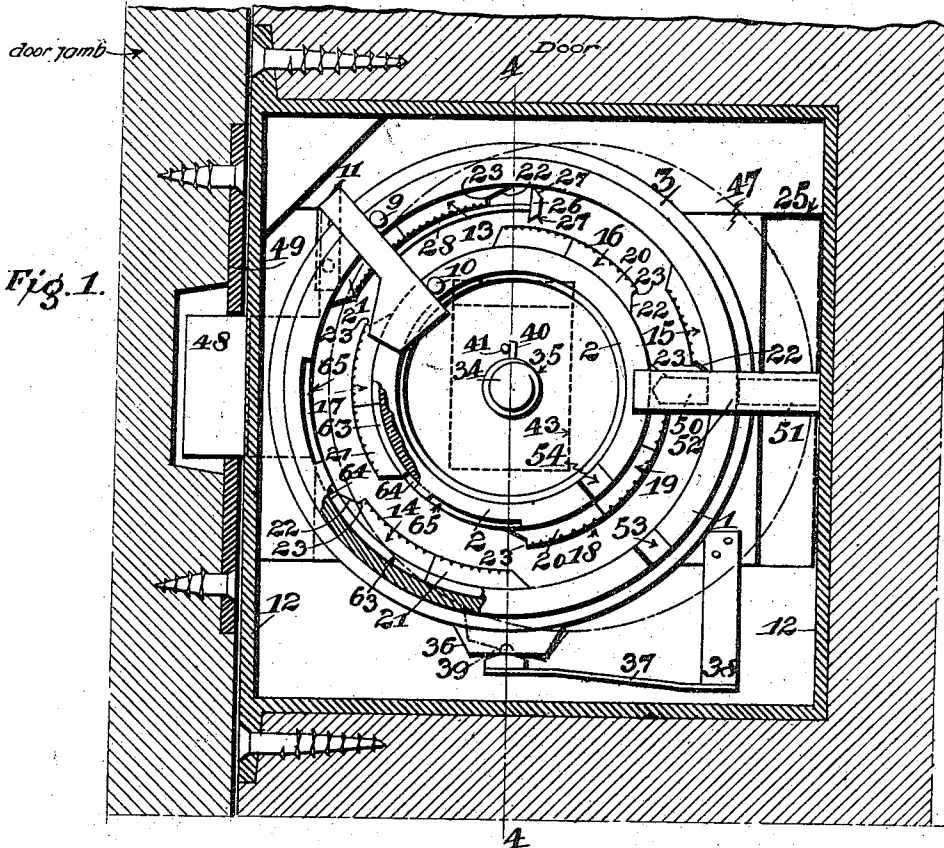
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KEYLESS LOCK.

APPLICATION FILED, SEPT. 6, 1916.

1,241,532.

Patented Oct. 2, 1917.

3 SHEETS—SHEET 1.



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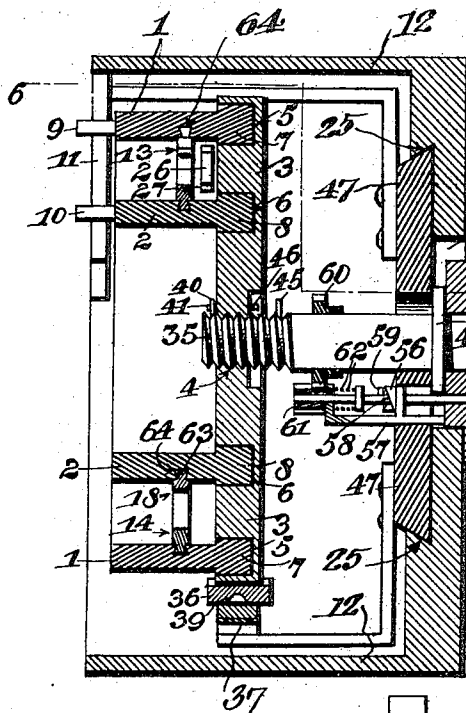


Fig. 4.

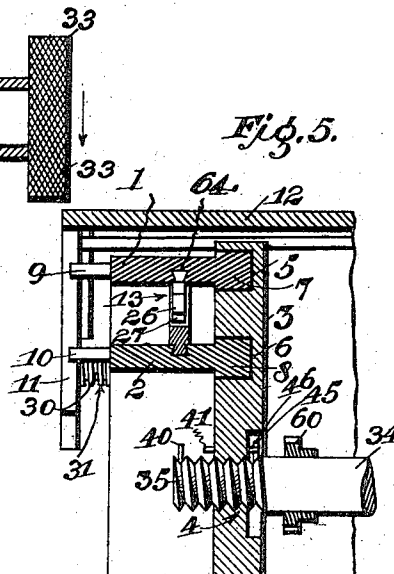


Fig. 5.

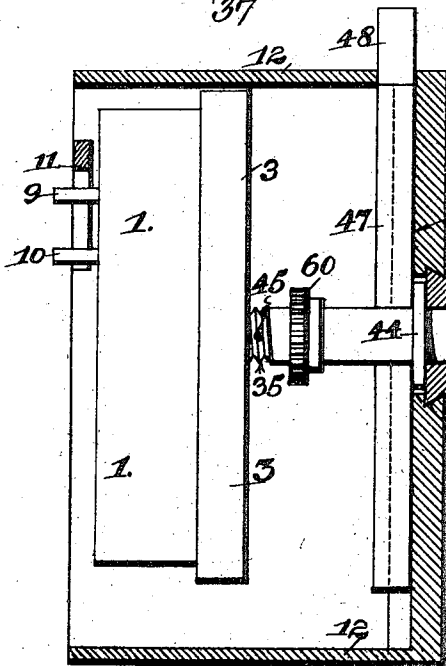


Fig. 6.

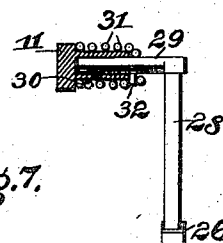


Fig. 7.

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KEYLESS LOCK.

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3 SHEETS—SHEET 3.

1,241,532.

Fig. 8

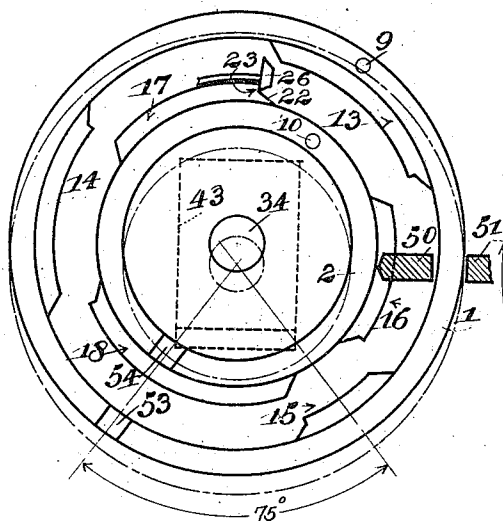


Fig. 9.

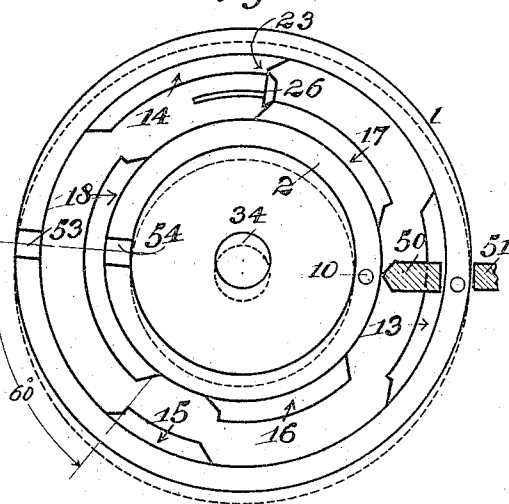


Fig. 10.

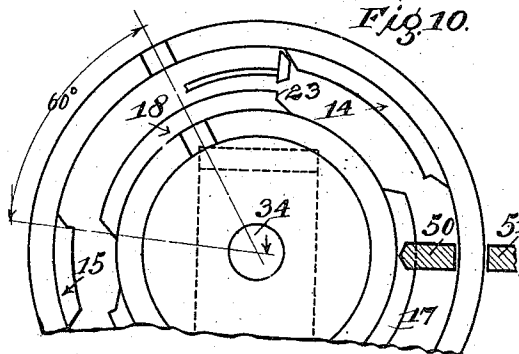


Fig. 11.

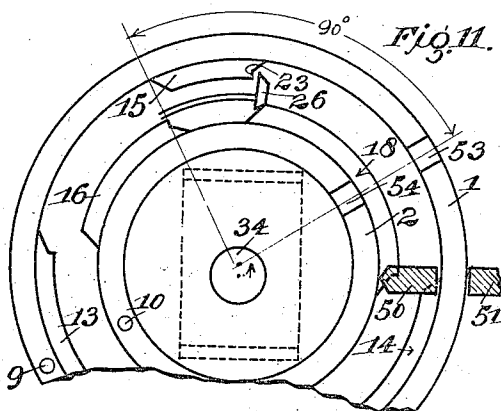
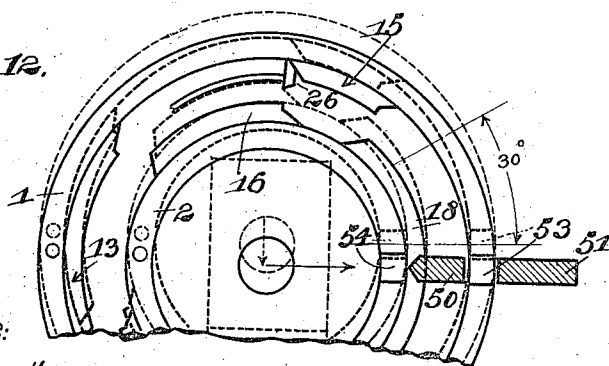


Fig. 12.



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# UNITED STATES PATENT OFFICE.

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## KEYLESS LOCK.

1,241,532.

Specification of Letters Patent.

Patented Oct. 2, 1917.

Application filed September 6, 1916. Serial No. 118,613.

### *To all whom it may concern:*

Be it known that I, JULES MACÉ, a citizen of the Republic of France, residing at Grasse, Alpes Maritimes, France, have invented a new and Improved Keyless Lock, of which the following is a specification.

My invention relates to improvements in combination locks, and it consists in the constructions, combinations and arrangements herein described and claimed.

An object of my invention is to provide a combination or permutation lock including a plurality of tumblers each of which has suitably disposed permutation elements, it being necessary to rotate the tumblers and to shift them bodily at predetermined times to reach the position at which the unlocking function is effected.

Another object of the invention is to provide an indicator by which the extent to which the tumblers are being turned, may be observed. The indicator is capable of producing an audible sound, and an impact to the finger of the operator. The number of sounds or impacts indicates the degree of rotation of the tumblers and is intelligible only to an operator acquainted with the combination of the lock.

Another object of the invention is to provide adjustable permutation elements which, for this purpose, are made in sections. The elements may thereby be lengthened or shortened as may be required for the purposes of a change in the combination of the lock.

Other objects and advantages will appear from the following specification, reference being had to the accompanying drawing forming a part thereof, in which:

Figure 1 is a cross section of a door and jamb showing my lock applied and in its locked position, the tumblers being in the normal position.

Fig. 2 is a diagrammatic view illustrating graphically the steps necessary to effect the unlocking by one combination.

Fig. 3 is a diagrammatic sectional view illustrating the association of the tumblers with the locking bits.

Fig. 4 is a cross section of the lock on the line 4—4 of Fig. 1, the tumblers and tumbler disk being in the normal position.

Fig. 5 is a view similar to Fig. 4 showing the tumbler disk advanced until the permutation elements aline with the permutation

latch, this constituting the first step in solving the combination.

Fig. 6 is a cross section on the line 6—6 of Fig. 4, parts being in plan.

Fig. 7 is a detail view of the permutation latch.

Figs. 8 to 12, inclusive are diagrammatic views illustrating the successive steps of the combination as shown in Fig. 2.

The lock includes essentially, a pair of circular tumblers 1 and 2. Of these tumblers, 2 is the one of lesser diameter and is disposed within but spaced apart from the outer tumbler 1, both tumblers, however, being concentric to a common axis. The tumblers 1 and 2 are supported by a permutation disk 3 which is provided with a centrally located threaded tumbler shaft opening 4 as shown in Fig. 4. The permutation disk 3 is also formed with a pair of concentric and annular grooves 5 and 6.

The respective tumblers 1 and 2 are provided with enlarged annular bases 7 and 8 which are disposed in the respective grooves 5 and 6, the contact between the two being sufficiently tight so as to cause the tumblers 1 and 2 to turn with the disk 3. The tumblers 1 and 2 are disposed in a certain predetermined position with relation to each other and they ordinarily remain in these relative positions. It is only when the lock is operated improperly, as by one who is not acquainted with the combination that there is a possibility of the relationship of the tumblers being disturbed. An attempt to turn the tumblers in a counterclockwise direction in Fig. 1 will fail because of suitable abutment pins but, the disk 3 may be turned relatively to the tumblers. The disk 3 is not ordinarily turned relatively to the tumblers 1 and 2 but on an occasion where through improper manipulation of the lock, the tumblers were moved out of alinement, the disk 3 may be counter-rotated until both abutment pins strike the abutment which indicates that the tumblers are again in proper alinement.

The tumblers 1 and 2 are prevented from turning in a counterclockwise direction in Fig. 1, by pins 9 and 10 which are arranged on the rear edges of the respective tumblers to engage a fixed arm 11. The arm 11 is supported by the bolt plate 47 of the lock which is conventionally shown in Figs. 1 and 4 of the drawings, it being understood

that the demands of actual practice will fix the designs and proportions of both the casing and the internal working parts.

Arranged on the interior of the tumbler 1 is a plurality of permutation elements 13, 14 and 15, while a series of similar permutation elements 16, 17 and 18 is arranged on the interior of the tumbler 2, as is plainly shown in Fig. 1.

It has been stated that the combination of the lock may be changed by adjusting the permutation elements. This is done by lengthening and shortening the elements. The element 18 shown in Fig. 1 is a typical one and illustrates plainly how it may be lengthened or shortened. It is made in sections as will be seen and consists of an inner portion 19 which is substantially rectangular. The element 18 or 13 also consists of a head portion 20 and a tail portion 21. The head portion 20 is provided with an inclined approach 22 which terminates in a shoulder 23, and the approach 22 insures a noiseless and easy ascent to the permutation latch 26.

The permutation latch 26 consists of a rectangular metallic body which is shaped to form abutments 27 of which there is one at the upper and lower side. The abutments 27 are adapted to cooperate with the respective permutation elements of the tumblers 1 and 2 and move into alinement with the shoulders 23, in a manner to be explained. An experienced operator will know when he has turned the tumblers through a predetermined number of degrees to cause the alinement of the latch 26 with one of the shoulders 23. The tumblers may thus be shifted in a manner to be explained so as to avoid an actual engagement between the shoulder 23 and its latch. Even should such an engagement occur no detrimental effect will ensue, since the frictional contact between the tumblers and the disk 3 is not considerable. It is only through a small effort that one or the other tumbler is displaced when the latch 26 has engaged a shoulder 23 and the disk 3 is turned. The surfaces of the permutation elements may be roughened, as shown in Fig. 1.

The latch 26 is supported by an extension 28 which is secured to a plunger 29, as shown in Fig. 7. The plunger 29 is lodged in a suitable receptacle 30 which is either secured to or forms a part of the arm 11. The plunger 29 and its corresponding seat in the receptacle 30, are non-circular in cross section so that the plunger is prevented from turning. The plunger 29 has a limited thrust however, and is kept normally in the position indicated in Fig. 7; a spring 31 is disposed about the receptacle 30 for this purpose, one end of the spring being in engagement with a stop 32 on the plunger 29. The spring 31 being of a retractile nature,

presses the stop 32 against the edge of the receptacle 30. The function of the spring 31 is to provide a yieldable connection between the permutation latch 26 and its support 11 to obviate a breakage of the arm 28 should the latch 26 become caught behind one of the permutation elements.

The disk 3 is moved over to the position shown in Fig. 5, by the rotation of the tumbler wheel 33. This constitutes the performance of the first step of the combination. The tumbler wheel 33 includes a tumbler shaft 34 which is screw threaded at its inner end as at 35 and the threaded end 35 engages the threaded opening 4 of the disk 3. By turning the tumbler wheel 33 in clockwise direction (Figs. 1 and 4) the disk 3 and its associated tumblers 1 and 2 are carried over into the position shown in Fig. 5. The permutation latch 26 will then be disposed between the profiles of the permutation elements 13 and 16, as shown in Fig. 5. The second step of the combination is now to be performed.

A brake holds the disk 3 from free rotation on the shaft 34. The brake consists of a block 36 which is supported by a strong leaf spring 37. The spring 37 is mounted on a member 38 attached to the part 47, a fulcrum pintle 39 being provided at one end of the spring 37 to permit the brake block 36 to follow the disk 3 in its lateral movements. In order to open the lock, it is a requirement in this particular embodiment of the device, to turn the tumbler wheel 33 in a clockwise direction in Fig. 1. If the wheel 33 should be turned in the opposite direction, however, no ill effect will follow since the disk 3 will simply be rotated against the friction of the engagement of the block 36 and that of the bases 7 and 8 of the tumblers 1 and 2. In this instance, the turning of the wheel 33 is imparted to the disk 3 by a pin 40 which engages a stop 41 on the disk 3. The absence of these stops 40 and 41 might tend to permit the unthreading of the disk 3 from the portion 35 of the shaft 34, and this is undesirable.

The brake block 36 just referred to is arranged to follow the disk 3 which is susceptible to vertical and lateral movements as will be explained. The engagement of the brake 36 prevents any free and objectionable rotational movement of the disk 3 when it is shifted as stated.

The tumbler shaft 34 is mounted in a sleeve 42 which extends forwardly from a face plate 43, the shaft 34 having a suitable collar 44 arranged in engagement with the rear surface of the face plate 43 to prevent endwise thrust of the shaft 34. Thus it will be seen that the disk 3 moves relatively to the shaft 34 when the tumbler wheel 33 is turned as previously explained and as indicated by the arrow in Fig. 4.

Another pin 45 is provided on the tumbler shaft 34 while a second pin 46 is provided on the tumbler disk 3, as shown in Fig. 4. As the disk 3 approaches the pin 45 and  
 5 nears the position shown in Fig. 5, the disk pin 46 will become engaged by the shaft pin 45. This constitutes the first step of the combination, the latch 26 being then in  
 10 alinement with the profiles of the permutation elements, as was previously explained. It will be seen in Figs. 1 and 4 that the lock housing 12 is provided with a vertically disposed dovetailed slideway 24 and a horizontally disposed dovetailed slideway 25. The  
 15 face plate 43 is correspondingly dovetailed to fit the slideway 24 as shown in Fig. 6.

Disposed in the slideway 25 and on the interior of the housing 12, is an inner bolt plate 47 which has suitably dovetailed edges  
 20 to conform to the surfaces of the slideway. The inner bolt plate 47 has an integrally formed bolt 48 at one side as shown in Fig. 1. For this reason the bolt plate 47 shall be termed the bolt plate since the movements  
 25 of the bolt plate 47 advance and retract the bolt 48 from the keeper 49 on the adjacent door jamb. The object of performing the successive steps of the combinations, as will  
 30 presently be followed, is to remove the obstructions from the free lateral movement of the bolt plate 47 so that the bolt 48 can be retracted and the door opened.

The obstructions to the lateral movement of the bolt plate 47 consist of bits 50 and 51  
 35 which are rigidly supported on a bit shank 52 in turn secured to the housing 12. The bits 50 and 51 are disposed in engagement with the tumblers 2 and 1, respectively as shown in Figs. 1 and 3. This engagement  
 40 prevents the tumblers 1 and 2, as well as the whole lock mechanism, from moving sideways. The tumblers 1 and 2 have slots 53 and 54 respectively formed on the rear edges and these slots are normally in radial aline-  
 45 ment as shown in Fig. 1. When the tumblers have been properly rotated to bring the slots 53 and 54 into alinement with the bits 50 and 51, then the disk 3 and bolt plate 47 may be moved laterally to open the lock, the  
 50 tumblers then sliding over the bits 50 and 51, as indicated in dot and dash lines in Figs. 1 and 3.

It has been explained that the first step of the combination consists in turning the  
 55 shaft 34 until the pin 45 engages the pin 46 on the disk 3. The performance of the second step of the combination consists in continuing to turn the tumbler wheel in a clockwise direction in Fig. 1. Since the pins 45  
 60 and 46 are in engagement, it is evident that the tumbler disk 3 will turn with the shaft 34. The disk 3 will turn but a short distance before the upper abutment 27 of the latch 26 will become engaged by the ap-  
 65 proach 22 of the head portion of the permu-

tation element 13, as shown in Fig. 1. By reference to Fig. 2, it will be seen that the amount of this movement is from *a* to *b*, or a distance of about 15°.

The continued rotation of the tumbler wheel 33 will cause the approach 22 to move  
 70 over the abutment 27 until it engages the shoulder 23 of the element 13. This position, when reached, constitutes the second step of the combination.

In performing the third step of the combination, it is first necessary to move the  
 75 shoulder 23 of the element 13 out of registration with the latch 26. This is done by lifting the disk and the carried tumblers 1 and 2, bodily, the face plate 43 then sliding  
 80 vertically in the dovetailed way 24. The disk 3 has now been elevated and the latch 26 freed from engagement with the shoulder 23 of the element 13. The latch 26 may now  
 85 pass between the profile of the element 13 and the surface of the inner tumbler 2 upon further rotation of the disk 3 through the medium of the tumbler wheel 33. The rota-  
 90 tion of the disk 3 is now continued in a clockwise direction while it remains in the elevated position until the lower abutment 27 of the latch 26 engages the shoulder 23  
 95 of the next permutation element 17. This position is shown in Fig. 8 and constitutes the end of the third step of the combination. The parts may be said to now come momentarily to rest but in actual practice the op-  
 100 erator will continue to rotate the tumbler disk 3, since he will be warned of the approach to the various abutments 23 so that he may elevate and lower the disk as may be required at the proper time. This warning mechanism will be presently described.

At the beginning of the fourth step, the  
 105 tumbler wheel 33 is moved downwardly so as to free the shoulder 23 of the element 17 from the latch 26. Further rotation of the wheel 33, and consequently the disk 3, will  
 110 dispose the latch 26 between the profile of the permutation element 17 and the interior of the tumbler 1. This may be indirectly observed in Fig. 8, in which it may be seen  
 115 that the disk 3 has again been moved downwardly to the dot and dash line position. This position indicates the end of the fourth step of the combination, and the operator  
 120 will immediately again elevate the disk 3 from the lower dotted line position. The full line position in Fig. 9 shows the disk 3 in the act of raising, it being nearly fully  
 125 elevated. When the disk is fully elevated, the latch 26 will be disposed between the element 14 and the tumbler 2 whereupon the fifth step may be accomplished.

The fifth step of the combination consists  
 130 in continuing the turning of the tumbler wheel 33 until the shoulder 23 of the element 18 is engaged by the latch 26, whereupon, as shown in Fig. 10, the disk 3 is again

lowered. The sixth step now consists in rotating the disk until the shoulder 23 of the element 15 is reached whereupon the disk is elevated. At the completion of the seventh step, the shoulder 23 of the element 16 will be engaged, the disk 3 still being elevated as indicated by dotted lines in Fig. 12. It will also be observed from this view, that the tumbler slots 53 and 54 are almost in registration with the bits 50 and 51.

When the disk 3 is now lowered the slots 53 and 54 will be in registration with the bits 50 and 51 and the eighth step of the combination may then be performed. The eighth step consists in moving the tumbler wheel 33 and its carried parts, laterally to the right, as in Figs. 1 and 3. This is now possible since the slots 53 and 54 move over the bits 50 and 51 and thus permit the retraction of the bolt 48 from the keeper 49, whereupon the door may be opened.

The degrees of rotation of the tumblers 1 and 2 may be observed by the operator and for this purpose, I provide a mechanism which indicates the different positions by producing audible sounds and light impacts to the finger. Both are produced by the same device and either may be observed. This indicator mechanism is necessary to indicate the instances when the respective shoulders 23 of the permutation elements 13, etc., reach the abutments 27 of the latch 26. The engagement of the shoulder 23 with the latch 26 does not prevent the tumbler wheel 33 from being turned farther, as is evident from the previous description and from Figs. 6 and 7. Therefore the indicator mechanism must perform the function of informing the operator of the time when the two engage so that he may perform the successive steps properly. If an error is made, the tumblers 1 and 2 must be turned back (counterclockwise in Fig. 1) until the pins 9 and 10 strike the arm 11 which is the starting position.

The indicator as above described consists of a pulsator pin 55 which protrudes slightly beyond the front of the face plate 43, as shown in Fig. 4. The operator may place his finger over the pin and feel its pulsations. The pulsations of the pin 55 are produced by an eccentric collar 56 which is secured in position on a bracket 57 pendent from the face plate 43. The collar 56 has a pair of inclined guideways 58 with which a pin 59 on the pulsator 55 engages. As the pulsator 55 rotates, the pin 59 will mount the incline 58 and fall to the level of the next incline at the place where the first incline ends and thus produce a click. The pulsator pin 55 is geared in such a manner that a click or impulse is performed at every 15 degrees of rotation of the disk 3, this being a feature presently to be explained. The pulsator 55 is rotated by a master gear

60 which is mounted on the shaft 34. The gear 60 engages a pinion 61 mounted on the pulsator 55 and rotates the pulsator 55, as indicated in Fig. 4. The pin 59 is pressed into engagement with the inclined ways 58, by a tension spring 62.

It has been stated that an impulse occurs at every 15 degrees of rotation of the disk 3. While I have employed this specific embodiment, it is obviously possible by changing the gearing 60 and 61 and the permutation elements 13 etc. to produce other combinations; the manner in which the opening of the lock is directed by the aid of the impulses of the pulsator pin 55, is graphically displayed in Fig. 2. Reference to Fig. 1 shows the latch 26 to be a slight distance from the shoulder 23 of the first element 13, while the stop pins 9 and 10 are in engagement with the arm 11; this is the normal position of the lock mechanism.

In operating the combination as has been previously explained, the disk 3 is rotated until the latch 26 engages the shoulder 23 of the first element 13 which is a distance of about 15° (see Fig. 2) and the first impulse or click of the pin 55 is produced. This occurs at the point b in Fig. 2 in which the path of the disk 3 is developed by the heavy line. The first click having been produced, the operator elevates the disk 3 (note the heavy line) and the rotation continues through 60°, a click being produced at 30° 45° and at 60°. The operator is thus apprised of the position of the tumblers and again lowers the disk 3. The total coaxial movement has now amounted to 75°, as indicated in Fig. 8 from which, and the succeeding figures, the passage of the bit slots 53 and 54 may be observed.

The 60° point at C (Fig. 2) having been reached, the disk 3 is lowered, the subsequent manipulations of the disk 3 being directed as explained in the previous description and directed by the clicks or pulsations of the pin 55. The audible sounds or impulses to be observed and the movements of the disk 3 in operating the combination are as follows, reference being again directed to Fig. 2:—rotate (15°)—one click, up; rotate (30°) two clicks—(30°) two clicks, down; rotate (30°) two clicks—(30°) two clicks, up; rotate (30°) two clicks—(30°) two clicks, down; rotate (30°) two clicks—(30°) two clicks—(30°) two clicks, up; rotate (30°) two clicks, down and move tumbler disk 33 laterally to unlock.

The number of the pulsations of the pin 55 thus indicates the position of the permutation elements and the operator is kept advised of the progress of the tumblers 1 and 2. If the operator is acquainted with the combination, he will know when to elevate and lower the tumbler wheel 33 hereinbefore pointed out.

The combination of the lock may be changed by altering the permutation elements which, as previously indicated, are adjustable. The portions 19, 20 and 21 of each element have dove-tailed keys 63 which fit tightly into annular dovetailed keyways 64 in the first instance, through lateral openings 65. The intermediate portions 19 of the permutation elements may be subtracted or added as the length of each element is required to be. The effect of the ability to change the portions of the permutation elements, means that an almost endless variety of combinations may be created since the stop shoulders 23 can be disposed of anywhere within the 360° of the circumference of the tumblers. By doing so, a different mode of operation will have to be observed in order to obtain the freedom of the locking bolt 48.

While I have described and illustrated one specific embodiment of my invention, it is obvious that many variations in the construction and method of operation may be effected without departing from the spirit of the invention or the scope of the appended claims.

What I claim is:

1. In a lock; the combination of a casing, tumblers concentrically disposed, permutation elements having shoulders arranged on the tumblers in annular opposition, a latch between the tumblers normally disposed out of alinement with the permutation elements, and means for coaxially advancing the permutation elements into alinement with the latch and for bodily moving the tumblers in unlocking.

2. In a lock; the combination of a casing, a bolt plate having a bolt, circular tumblers concentrically disposed supported by said bolt plate, each of said tumblers having a bit passage, bits supported by the casing in engagement with the tumblers, permutation elements having shoulders arranged on the tumblers in annular opposition, a latch between the tumblers normally disposed out of alinement with the permutation elements, means for laterally advancing the permutation elements into alinement with the latch, and associated means for rotating the tumblers and bodily moving them whereby to bring the bit passages into registration with the bits.

3. In a lock; the combination of a casing, tumblers concentrically disposed, each of the tumblers having a bit passage, a bolt plate supporting the tumblers, bits fixed on the casing and engaged by the tumblers, permutation elements on the tumblers, a latch between the tumblers normally out of alinement with the permutation elements, means for laterally advancing the tumblers and permutation elements into alinement with the latch, and means for advancing the tumbler bit passages into registration

with the bits, said means being normally ineffectual and for bodily moving the tumblers in unlocking.

4. In a lock; the combination of a casing, tumblers concentrically disposed, each of the tumblers having a bit passage, a bolt plate having a locking bolt, bits on the casing in engagement with the tumblers, permutation elements on the tumblers, a latch between the tumblers normally out of alinement with the permutation elements, means for laterally advancing the permutation elements into alinement with the latch, means adapted to advance the tumbler bit passages into registration with the bits, said means being normally ineffectual, and a head portion having a shoulder included in each permutation element engageable by the latch for retarding the advance of the tumblers, said tumblers being bodily movable in unlocking.

5. In a lock; the combination of a fixed latch, laterally movable and rotatable tumblers, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, means for advancing the permutation elements laterally into the plane of the latch, and means for subsequently rotating the tumblers, said tumblers being bodily movable in unlocking.

6. In a lock; the combination of a relatively fixed latch, circular movable and rotatable tumblers having bit passages, stationary bits engaged by the tumblers, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, means for advancing the permutation elements laterally into alinement with the latch, means for subsequently rotating the tumblers and adapted to bring the bit passages into registration with the bits, and shouldered portions included in the permutation elements engageable by the latch, said tumblers being bodily movable in unlocking.

7. In a lock; the combination of a relatively fixed latch, circular movable and rotatable tumblers having bit passages, a bolt plate supporting the tumblers, locking bits engaged by the tumblers, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, means for advancing the permutation elements laterally into alinement with the latch, means for subsequently rotating the tumblers and adapted to bring the bit passages into registration with the bits, and shouldered portions included in the permutation elements adapted to be alternately engaged by the latch and for bodily moving the tumblers in unlocking.

8. In a lock; the combination of a relatively fixed latch, circular movable and rotatable tumblers having bit passages, a bolt plate supporting the tumblers, locking bits

engaged by the tumblers, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, means for advancing the permutation elements laterally into alinement with the tumblers and adapted to bring the bit passages into registration with the bits, and shouldered portions included in the permutation elements adapted to be alternately engaged by the latch, and means for freeing the shouldered portion of the permutation element.

9. In a lock; the combination of a relatively fixed latch, circular movable and rotatable tumblers having bit passages, a bolt plate supporting the tumblers, locking bits engaged by the tumblers, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, means for advancing the permutation elements laterally into alinement with the latch, means for subsequently rotating the tumblers and adapted to bring the bit passages into registration with the bits, shouldered portions included in the permutation elements adapted to be alternately engaged by the latch, and means for freeing the shouldered portion of the permutation elements, said tumblers being bodily movable in unlocking.

10. In a lock; the combination of a relatively fixed latch, a laterally movable and rotatable tumbler disk, circular concentrically disposed tumblers supported by the disk, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, a relatively fixed but rotatable tumbler shaft having a threaded end entering the disk, a face plate supporting the shaft, means including a tumbler wheel adapted to be turned for advancing the permutation elements into the plane of the latch, pins on the disk and shaft adapted to engage when the planes of the permutation elements and latch coincide to effect the subsequent rotation of the disk in one direction upon further turning of the tumbler wheel, said tumblers being bodily movable in unlocking.

11. In a lock; the combination of a relatively fixed latch, a laterally movable and rotatable tumbler disk, circular concentrically disposed tumblers supported by the disk, permutation elements on the tumblers in annular opposition and normally out of the plane of the latch, a relatively fixed but rotatable tumbler shaft having a threaded end entering the disk, means including a tumbler wheel adapted to be turned for advancing the permutation elements into the plane of the latch, pins on the disk and shaft adapted to engage when the planes of the permutation elements and latch coincide to effect the subsequent rotation of the disk

in one direction upon further turning of the tumbler wheel; and means for indicating the degrees of rotation of the disk.

12. In a lock; the combination of the tumbler disk having concentric grooves and an axial threaded opening, tumblers having enlarged bases disposed in the grooves, a tumbler shaft, a pin on the end of the shaft and on the adjacent side of the disk adapted to engage when the shaft is turned in one direction, a tumbler shaft having a threaded end engaging the disk opening, a tumbler wheel on the shaft adapted to be turned in the opposite direction to move the disk, another pin on the shaft and on the opposite and adjacent side of the disk adapted to engage when the shaft is subsequently turned in the same direction, and a collar preventing the end thrust of the shaft.

13. In a lock; the combination of the tumbler disk having concentric grooves and an axial threaded opening, tumblers having enlarged bases disposed in the grooves, a tumbler shaft, a pin on the end of the shaft and on the adjacent side of the disk adapted to engage when the shaft is turned in one direction, a tumbler shaft having a threaded end engaging the disk opening, a tumbler wheel on the shaft adapted to be turned in the opposite direction to move the disk, another pin on the shaft and on the opposite and adjacent side of the disk adapted to engage when the shaft is subsequently turned in the same direction, a collar preventing the end thrust of the shaft, and a brake for the disk.

14. In a lock; the combination of circular concentric tumblers, a relatively fixed latch therebetween, a supporting tumbler plate or disk for the tumblers, permutation elements arranged alternately on the respective outer and inner surfaces of the tumblers adjacent to the latch to form a variant passage, the planes of the elements and latch being out of alinement, a tumbler shaft having a threaded connection with the tumbler disk, the shaft being held from end thrust, the threaded connection alining the permutation elements and the latch when the shaft is turned in one direction, associated connectible means between the shaft and disk to rotate the disk upon subsequent turning of the shaft, shoulders included in the head of each permutation element engageable by the latch alternately, and means for off-setting the respective shoulders from the latch to permit subsequent turning of the tumblers.

15. In a lock; the combination of the tumbler plate or disk, a tumbler shaft having a threaded engagement with the disk, means for preventing end thrust of the shaft, a tumbler wheel for turning the shaft and displacing the disk laterally, engaging pins for rotating the disk upon subsequently turning the tumbler wheel in one direction,

a brake engaging the periphery of the disk, and pivotal supporting connections permitting the brake to follow the disk in its lateral displacements.

5 16. In a lock; the combination of a relatively fixed latch, permutation elements out of the plane of the latch, tumblers supporting the permutation elements, a plate or disk supporting the tumblers, a tumbler shaft, a bolt plate supporting the shaft, means for causing the planes of the permutation elements and the latch to coincide, engageable means for subsequently causing the disk to rotate in one direction, 10 shouldered head portions included in the permutation elements for engaging the latch, an indicator for revealing the moment of engagement, and means for disengaging the latch and shoulder.

20 17. In a lock; the combination of a casing, a plate or disk having concentric grooves and an axial threaded opening, tumblers having enlarged bases disposed in the grooves, a tumbler shaft having a threaded end engaging the disk opening, a pin on the end of the shaft and on the adjacent side of the disk adapted to engage when the shaft is turned in one direction, a stop pin on each tumbler, and a stop arm engageable by the 30 pins.

18. In a lock; the combination of a casing, an arm on the casing, a receptacle on the arm, a plunger in the receptacle, a yieldable connection therebetween, a semi-yielding 35 arm on the plunger, a latch on the end of the arm, the latch having abutments, permutation elements associated with the latch but being normally out of the plane of the latch, shouldered portions included in the said elements, tumblers supporting the permutation elements, a permutation plate or disk supporting the tumblers, and means for displacing the disk to coincide the planes of a latch and permutation elements.

45 19. In a lock; the combination of a tumbler having an annular dovetailed groove and a side opening, permutation elements, having dovetailed keys to be seated in the annular groove, the permutation elements including a shouldered head portion.

20. In a lock; the combination of a relatively fixed latch, concentric tumblers, permutation elements on the tumblers normally out of the plane of the latch, means for bringing the elements into the plane of the latch, an arm supporting the latch, a non-circular plunger on the arm, a receptacle for the plunger, a support for the receptacle, and a retractile spring connection between 60 the plunger and the receptacle.

21. In a lock; the combination of the tumbler shaft, a face plate having a collar in

which the tumbler shaft is disposed, the face plate having an aperture, a pulsator for protruding through the aperture, a collar 65 having a plurality of inclines, a pin on the pulsator engaging the inclines, a spring pressing the pin into engagement, and a gear train between the tumbler shaft and the pulsator for rotating the latter.

22. In a lock; the combination of the tumbler shaft, a face plate or disk having a collar in which the tumbler shaft is disposed, the face plate having an aperture, a pulsator for protruding through the aperture, 75 a collar having a plurality of inclines, a pin on the pulsator engaging the inclines, a spring pressing the pin into engagement, a pinion on the pulsator, and a gear on the tumbler shaft to rotate the pinion.

23. In a lock; the combination of a casing, a bolt plate having a bolt adapted to engage a keeper, rotatable concentric tumblers having bit slots and supported by the face plate, bits supported by the casing in engagement 85 with the tumblers, means for rotating the tumblers adapted to aline the slots and bits, and elements on the tumblers for obstructing the rotational movement of said tumblers.

24. In a lock, the combination of a casing, a bolt plate having a bolt adapted to engage a keeper, rotatable concentric tumblers having bit slots and supported by the face plate, bits supported by the casing in engagement 95 with the tumblers, means for rotating the tumblers adapted to aline the slots and bits, elements on the tumblers for obstructing the rotational movement of said tumblers, and means for overcoming the obstructions to obtain the alinement of the slots and bits.

25. In a lock; the combination of a casing, bits on the casing, a bolt plate adapted to slide horizontally on the casing and having a bolt, concentric tumblers supported by the 105 bolt plate in engagement with the bits, the tumblers having radially alined bit passages or slots normally out of registration with the bits, permutation elements in annular opposition on the tumblers to form a variant passage, a latch in the passage engageable by the permutation elements, means for rotating the tumblers adapted to bring the bit passages or slots into registration with the bits, and means associated with the tumblers and bolt plate for moving the tumblers vertically and disengaging the permutation elements from the latch successively to permit the rotation of the tumblers.

JULES MACÉ.

Witnessed by—

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