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LOCK.

No. 914,819.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERASME GAGNON, a citizen of the United States, residing at Central Falls, in the county of Providence and State of Rhode Island, have invented a new and useful Improvement in Locks, of which the following is a specification.

This invention has reference to an improvement in locks and more particularly to an improvement in combination locks.

The object of my invention is to improve the construction of a combination lock whereby when once set by any one of a plurality of combinations, it is practically impossible to open the lock by any of the well known expert methods in use, such as feeling or listening at the lock while turning the combination knob.

My invention consists in the peculiar and novel construction of a combination lock, said lock having details of construction, as will be more fully set forth hereinafter and claimed.

Figure 1 is a front view of the lock, showing the combination knob at the starting point of a combination which begins with the letter F and the bolt in the locked position. Fig. 2 is an interior view of the lock with the front plate removed and showing the mechanism and bolt in the locked position in full lines and in the unlocked or open position in broken lines. Fig. 3 is an enlarged front view of the combination gear removed from the lock to more clearly show the construction of the same. Fig. 4 is a still further enlarged detail view of a portion of the combination gear showing the unlocking stud and the construction of the springs and grooves in the gear. Fig. 5 is an enlarged detail sectional view taken on line 5 5 of Fig. 4, showing the construction of the detachably secured unlocking stud, and Fig. 6 is an enlarged detail sectional view taken on line 6 6 of Fig. 2 through the lever and slide of the locking mechanism.

In the drawings, *a* indicates the lock frame, *b* the front plate, *c* the combination knob, *d* the pinion, *e* the combination gear, *f* the operating lever, *g* the slide, *h* the bolt, and *i* the spring click lever of my improved combination lock.

The lock frame *a* is in the form of a shallow box open at the front and having an opening 7 in the face plate for the bolt *h*, an interior lug 8 at the top, a leaf spring 9 secured at one end to the lug and extending

toward the face plate, a bearing for the hub of the pinion *d*, and a central bearing for the shaft of the combination gear *e*.

The front plate *b* is shaped to close the open front of the lock frame *a* and has a bearing for the hub of the pinion *d*, a central bearing for the shaft of the combination gear *e*, an indicating line X adjacent the combination knob *c*, and is secured to the lock frame *a* by screws, as shown in Fig. 1.

The combination knob *c* has an annular concentric flange 10 (adjacent the front plate *b*) the face of which is divided into sixteen (16) equal spaces which are lettered from A to P, as shown in Fig. 1. The knob *c* is secured to a stem 11 which extends through the front plate *b*, the hub of the pinion *d* and the frame *a* and has a transverse pin 12 which enters a transverse slot 14 in the hub of the pinion *d*, as shown in Fig. 2. The opposite end of the stem 11 is detachably secured by a combination knob similar to the knob *c* previously described on the back of the lock frame *a* or by any other well known means.

The pinion *d* has a hub 13 in which is a transverse slot 14 for the pin 12, fifteen (15) teeth, as shown in Fig. 2, the letter A between two of the teeth, and is rotatably held in its operative position in the lock by the hub 13, the ends of which are shouldered and enter the bearings in the lock frame *a* and front plate *b*.

The combination gear *e* is loosely mounted on a central shaft 15 which is detachably assembled in the casing and said gear has sixty (60) teeth meshing with the pinion *d*, every sixth tooth of which is numbered, the numbers running from 0 to 9, as shown in Fig. 3. A series of six (6) concentric circular ribs 16, 17, 18, 19, 20 and 21 form a part of or are secured to the flat front side of the gear and form a series of six (6) concentric circular grooves 22, 23, 24, 25, 26 and 27 between the ribs. Each of the ribs 16, 17, 18, 19 and 20 have a series of openings connecting the grooves, all but one of the openings in each rib being normally closed by a curved leaf spring secured at one end to the rib and extending across the opening, and all of the openings in each rib have a bent leaf spring secured at one end to the rib and extending through the openings into the adjacent outer groove, the ends of the springs resting on the outer walls of the grooves. The inner rib 16 has three openings 28 28

normally closed by leaf springs 29 29 and having leaf springs 30 30 extending from the right edge of the openings to the left into the groove 23, and an opening 31 minus a leaf spring 29 and connecting the groove 22 with the groove 23 and having a leaf spring 30 extending from the right edge of the opening to the left into the groove 23. The next outer rib 17 has three openings 28 28 normally closed by leaf springs 29 29 and having leaf springs 30 30 extending from the left edge of the openings to the right into the groove 24, and an opening 32 minus a leaf spring 29 and connecting the groove 23 with the groove 24 and having a leaf spring 30 extending from the left edge of the opening 32 to the right into the groove 24. The next outer rib 18 has six openings 28 28 normally closed by leaf springs 29 29 and having leaf springs 30 30 extending from the left edge of the openings to the right into the groove 25, and an opening 33 minus a leaf spring 29 and connecting the groove 24 with the groove 25 and having a leaf spring 30 extending from the left edge of the opening 33 to the right into the groove 25. The next outer rib 19 has seven openings 28 28 normally closed by leaf springs 29 29 and having leaf springs 30 30 extending from the right edge of the openings to the left into the groove 26, and an opening 34 minus a leaf spring 29 and connecting the groove 25 with the groove 26 and having a leaf spring 30 extending from the left edge of the opening 34 to the right into the groove 26. The next outer rib 20 has seven openings 28 28 normally closed by leaf springs 29 29 and having leaf springs 30 30 extending from the left edge of the openings to the right into the groove 27 and an opening 35 minus a leaf spring 29 and connecting the groove 26 with the groove 27 and having a leaf spring 30 extending from the right edge of the opening 35 to the left into the groove 27. The outer rib 21 has a click tooth 36 secured to the outer circumference of the rib adjacent the numeral 6 on the gear, a series of eight (8) notches 37 37 in the edge of the rib, a series of eight (8) holes 38 38 through the gear on a line with the notches 37 37 and a beveled side unlocking stud 39 shaped to fit in the notches 37 37 on the inner circumference of the rib and having a screw threaded stem 40 extending through a hole 38 and detachably secured to the gear by a nut 41 on the opposite side of the gear, as shown in Figs. 3, 4 and 5.

The operating lever *f* is pivotally secured at its upper end 42 to the lug 8 on the frame *a* and has the arm 43 extending at right angles toward the face plate and shaped to grasp the free end of the leaf spring 9 which holds the lever in its normal central position, the central segmental opening 44 for the shaft 15 of the gear *e*, the lower end

45 and the slot 46 extending vertically from the end 45 to the opening 44 forming guide-ways for the slide *g*, as shown in Fig. 2. The slide *g* is shaped to have a vertical sliding movement on the lever *f* and has an inwardly-extending pin 47, as shown in Fig. 6, which enters the grooves in the combination gear *e*, as shown in section in Fig. 3.

The bolt *h* extends through the opening 7 in the face plate of the lock frame *a* and has the vertical portion 48 merging into the horizontal portion 49 which extends under the combination gear *e* and has the cutaway portion 50, forming the shoulder 51 on the end for the end 45 of the operating lever *f*. The bolt *h* is guided horizontally by a web on the frame and has the usual coiled spring 52 for holding the bolt in the locked position, as shown in broken lines in Fig. 2. A leaf spring 53 is secured at its lower end to the horizontal portion 49 of the bolt and extends upward back of the portion 48 and has a tooth 54 on its upper end in a position to engage with the teeth of the combination gear *e*.

The spring click lever *i* is pivotally secured to a stud 55 on the lock frame *a* and has the lower end 56 in a position to engage with the click tooth 36 on the gear *e* and the upper end 57 having the beveled tooth 58 in a position to engage with the teeth of the pinion *d*, as shown in Fig. 2.

The combinations are changed by changing the position of the teeth indicated by the letter A on the pinion *d* relative to the teeth on the combination gear *e* indicated by the numerals 0 to 9 on the gear, and by changing the position of the unlocking stud 39 in the notches 37 37. To set the mechanism for the F combination, as shown in the drawings, the pinion *d* and gear *e* are placed so as to bring the tooth indicated by the numeral 7 on the gear *e* between the teeth indicated by the letter A on the pinion *d* and by securing the locking stud 39 in the notch 37 adjacent the numeral 8 on the gear *e*.

In the operation of unlocking my improved combination lock by the F combination, the combination knob *c* is turned slowly to the left until a click is felt on the knob caused by the click tooth 36 on the combination gear *e* engaging with the lower end 56 of the click lever *i* and throwing the tooth 58 on the upper end 57 of the click lever *i* into the teeth of the pinion *d*, as shown in Fig. 2. The letter F on the knob *c* now coincides with the indicating line X on the lock, as shown in Fig. 1. The knob *c* and letter F are now revolved to the right three times, then to the left once, which moves the pin 47 on the slide *g* out of the groove 22 down through the opening 31 into the groove 23. The knob *c* is now revolved to the left until the letter D coincides with the line X, then to the right two times and continued

to the right until the letter E coincides with the line X, which moves the pin 47 on the slide *g* out of the groove 23 down through the opening 32 into the groove 24. The knob C is now revolved to the left one complete revolution, which moves the pin 47 on the slide *g* out of the groove 24, down through the opening 33 into the groove 25. At this stage the letter E now coincides with the line X and the knob C is now revolved to the left until the letter A coincides with the line X which moves the pin 47 on the slide *g* out of the groove 25 down through the opening 34 into the groove 26. The knob C with the letter A is now revolved to the right three times and continued to the right until the letter I coincides with the line X, then the knob C with the letter I is revolved to the left three times and continued to the left until the letter F coincides with the line X which moves the pin 47 on the slide *g* out of the groove 26 down through the opening 35 into the groove 27. The knob C with the letter F is now revolved to the right, which brings the unlocking stud 39 into engagement with the pin 47 on the slide *g* and through the pinion *d*, the gear *e*, the stud 39, the slide *g*, and the lower end 45 of the lever *f*, engaging with the shoulder 51 on the bolt *h*, moves the bolt *h* against the tension of the coiled spring 52 toward the back of the lock and unlocks the same. The inward movement of the bolt *h* brings the tooth 54 on the leaf spring 53 into engagement with the teeth on the gear *e* and locks the same, as shown in broken lines in Fig. 2, thereby preventing further movement of the gear or strain on the mechanism. The springs 29, serve as keepers to confine the pin 47 within the several ribs until the proper point in the rotation of the pinion *e* is reached at which time said pin drops through the open space not bridged by a spring 29. The springs 30 act positively as guides and also as cam lifting means to move the pin 47 inwardly toward the center of the pinion *e* when the lock is being reset.

It will be understood that when the operative rotation of the knob C is stopped and the bolt *h*, is released, the letter E appears at the line *x* and the stud 39 is adjacent the pin 47.

The combination of the lock is set after the door is locked by revolving the knob *c* with the letter E to the left once, then once to the right and then three times to the left. This brings the pin 47 on the slide *g* back through the several grooves and openings into the inner groove 22, as shown in section in Fig. 3, and raises the slide *g* into its normal operative position, as shown in Fig. 2.

In the operation stated in the foregoing paragraph, the first movement of the pinion *d* revolves the gear *e* one fourth of a revolution. The second or reverse movement of

said pinion reverses the movement of the gear *e* one fourth of a revolution and brings the pin 47 back to practically the starting point, but in such second movement of the gear *e* one fourth of a revolution and brings groove by the spring means described. By moving the gear *e* three-fourths of a revolution in the direction of its initial movement aforesaid, the pin 47 will pass through the various grooves into the center 22 at which time the operation of resetting the combination mentioned in the foregoing paragraph is accomplished.

Having thus described my invention, I claim as new and desire to secure by Letters Patent;—

1. In a combination lock, a bolt, a lever operatively connected with the bolt, a combination knob, a stem on the knob extending through the lock, a pinion on the stem, a gear in the lock meshing with the pinion, and means operatively connecting the gear with the lever to move the latter from the former, whereby on certain predetermined manipulations of the combination knob the bolt is moved by the lever inward and the lock unlocked.

2. In a combination lock, a bolt, a lever operatively connected with the bolt, a slide on the lever, a combination knob, a stem on the knob extending through the lock, a pinion on the stem in the lock, a gear in the lock meshing with the pinion, and means on the gear operatively connected with the slide, whereby on certain predetermined manipulations of the combination knob the bolt is moved by the lever inward and the lock unlocked.

3. In a combination lock, a bolt, a pivoted lever operatively connected with the bolt, a slide on the lever, a pin on the slide, a combination knob, a stem on the knob extending through the lock, a pinion on the stem in the lock, a gear in the lock meshing with the pinion, and means on the gear operatively connected with the pin on the slide, whereby on certain predetermined manipulations of the combination knob the bolt is moved inward by the lever and the lock unlocked.

4. In a combination lock, a bolt, a pivoted lever operatively connected with the bolt, a slide on the lever, a pin on the slide, a combination knob, a stem on the knob extending through the lock, a pinion on the stem in the lock, a gear in the lock meshing with the pinion, a stud on the gear, and means on the gear whereby on certain predetermined manipulations of the combination knob the stud on the gear is brought into engagement with the pin on the slide and through the slide and lever the bolt is moved inward and the lock unlocked.

5. In a combination lock, a bolt, a vertical lever pivotally and removably secured at its upper end in the lock and operatively con-

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nected with the bolt, a slide on the lever, a
pin on the slide, a combination knob, a stem
on the knob extending through the lock, a
pinion detachably secured to the stem in the
5 lock, a gear detachably and rotatably se-
cured in the lock and meshing with the pin-
ion, a stud detachably secured to the gear,
and means on the gear whereby on certain
predetermined manipulations of the com-
10 bination knob the stud on the gear is brought
into engagement with the pin on the slide
and through the slide and lever the bolt is
moved inward and the lock unlocked.

6. In a combination lock, a frame, a bolt
15 extending through an opening in the frame,
a pivoted lever operatively connected with
the bolt, a spring adapted to hold the lever
in its normal vertical position, a slide on the
lever, a pin on the slide, a combination knob,
20 a stem on the knob extending through the
lock, a pinion on the stem in the lock, a gear
rotatably supported in the lock and meshing
with the pinion, a stud on the gear, a series
of concentric circular ribs on the gear form-
25 ing concentric circular grooves and having
openings normally closed by leaf springs,
leaf springs extending from the openings
into the grooves, each rib having an open-
ing connecting the grooves and a leaf spring
30 extending from the openings into the
grooves, whereby on certain predetermined
manipulations of the combination knob the
slide is moved downward on the lever, the
stud on the gear is brought into engagement
35 with the pin on the slide and through the
slide and lever the bolt is moved inward and
the lock unlocked.

7. In a combination lock, a bolt, a lever
operatively connected with the bolt, a slide
40 on the lever, a pin on the slide, a combina-
tion knob, a stem on the knob extending
through the lock, a pinion on the stem in
the lock, a gear rotatably supported in the
lock and meshing with the pinion, a stud on
45 the gear, a series of concentric circular ribs
on the gear, a series of concentric circular
grooves between the ribs, the said ribs hav-
ing openings normally closed by leaf

50 springs, leaf springs extending from the
openings into the grooves and each rib hav-
ing an opening connecting the grooves and
a leaf spring extending from the openings
into the grooves, whereby on certain prede-
termined manipulations of the combination
knob the slide is moved upward on the lever
55 into its normal operative position and the
combination of the lock set.

8. In a combination lock, a combination
gear *e* having a series of concentric circular
ribs 16, 17, 18, 19, 20 and 21 on the gear, a 60
series of concentric circular grooves 22, 23,
24, 25, 26, and 27 between the ribs, each of
the ribs having a series of openings 28 28
connecting the grooves, all but one of the
openings in each rib being normally closed 65
by a curved leaf spring 29 secured at one
end to the rib, and all of the openings in
each rib having a bent leaf spring 30 se-
cured at one end to the rib and extending
through the openings into the adjacent outer 70-
groove, a click tooth 36 secured to the outer
face of the rib 21, a series of notches 37 37
in the edge of the rib 21 on the gear *e* which
has a series of holes 38 38 on a line with the
notches 37 37, an unlocking stud 39 shaped 75
to fit in the notches 37 37 and having a
screw-threaded stem 40 extending through a
hole 38 and detachably secured to the gear
by a nut 41, as described.

9. In a combination lock, the combina- 80
tion of the following instrumentalities; a
lock frame *a*, a front plate *b*, a combination
knob *c*, a pinion *d*, on the stem of the knob,
a combination gear *e* meshing with the pin-
ion, an operating lever *f* pivotally secured 85
in the lock, a slide *g* on the operating lever,
a bolt *h*, a spring click lever *i*, and means
operatively connecting the lever and the
slide to move the latter from the former.

In testimony whereof I have signed my 90
name to this specification in the presence of
two subscribing witnesses.

ERASME GAGNON.

Witnesses:

ADA E. HAGERTY,
J. A. MILLER.