(Model.)

3 Sheets—Sheet 1.

A. C. LAWRENCE.

COMBINATION LOCK.

No. 476,751. Patented June 7, 1892.

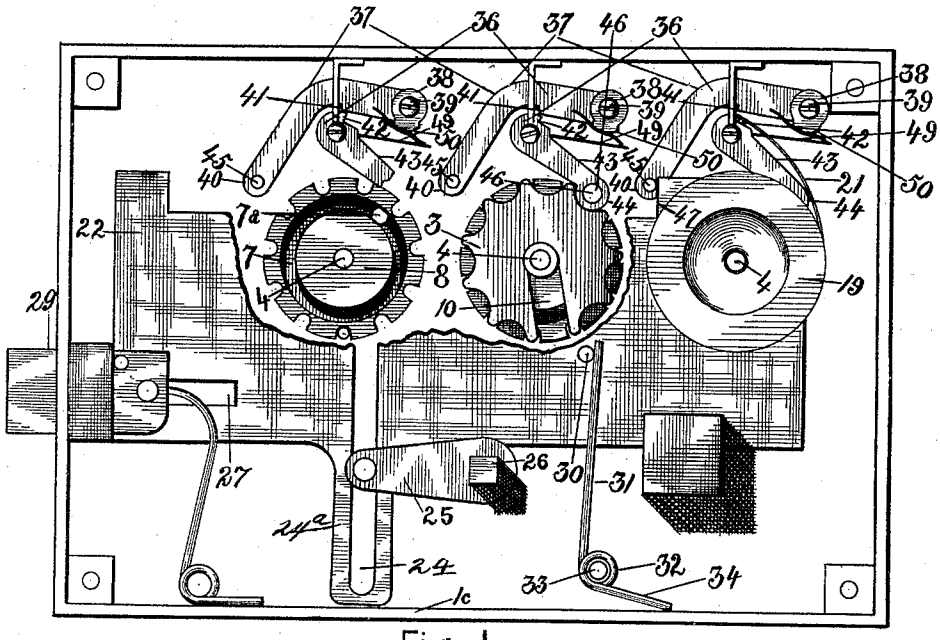

Fig. 1.

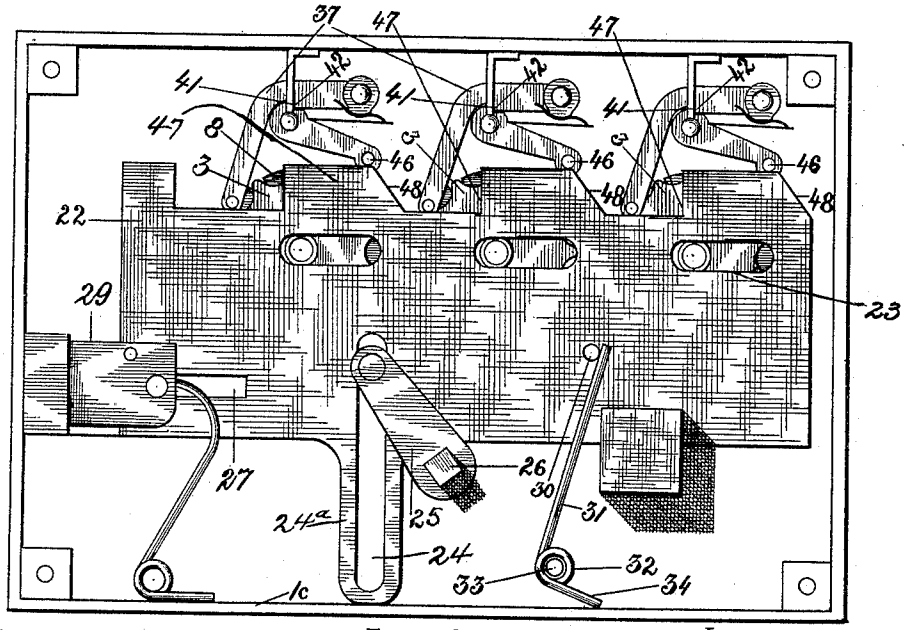

Fig. 8.

Witnesses
James McAdam
M. E. Angell.

Inventor.
Alfred C. Lawrence
by Chas H. Riches
His Attorney

(Model.)

3 Sheets—Sheet 2.

A. C. LAWRENCE.

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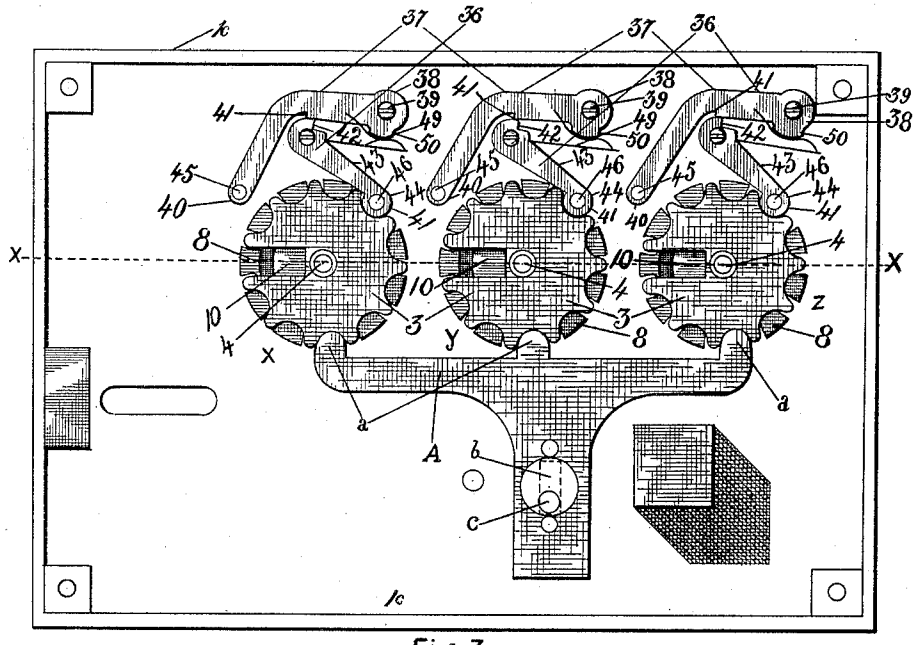

Fig.3

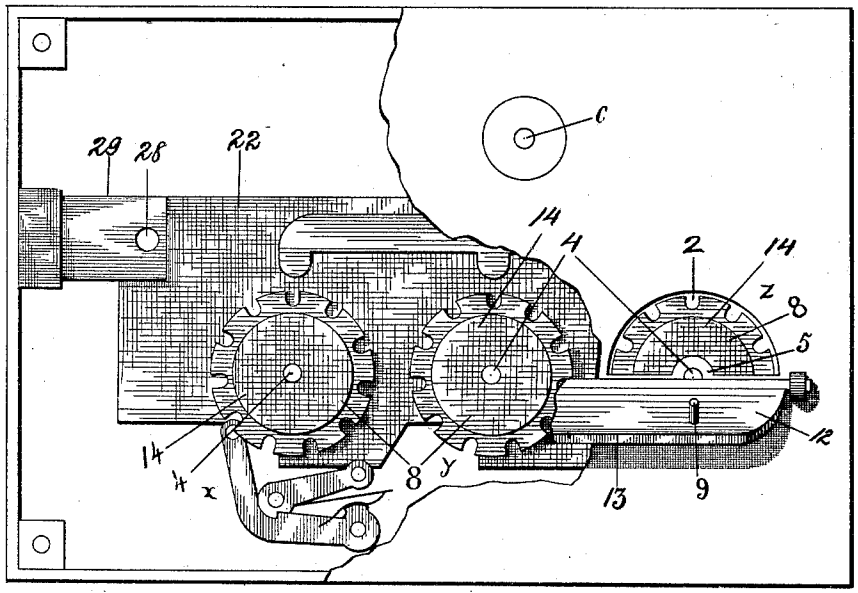

Fig.2.

Witnesses.
James McAdam.
M. E. Angell.

Inventor.
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His attorney.

(Model.) 3 Sheets—Sheet 3.

A. C. LAWRENCE.

COMBINATION LOCK.

No. 476,751. Patented June 7, 1892.

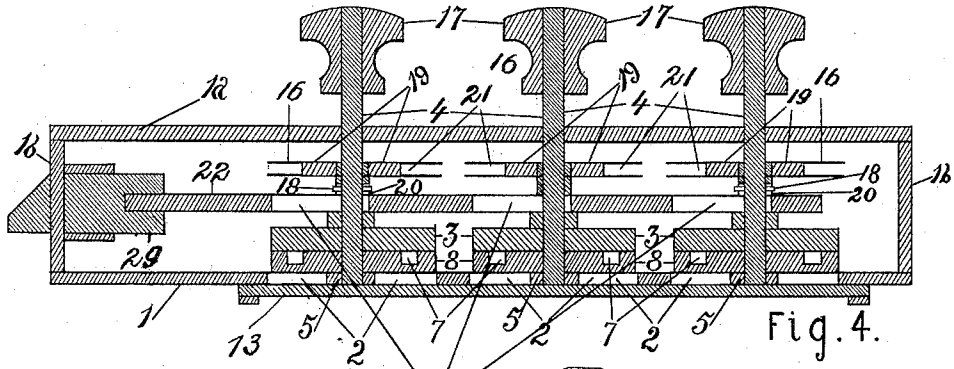

Fig. 4.

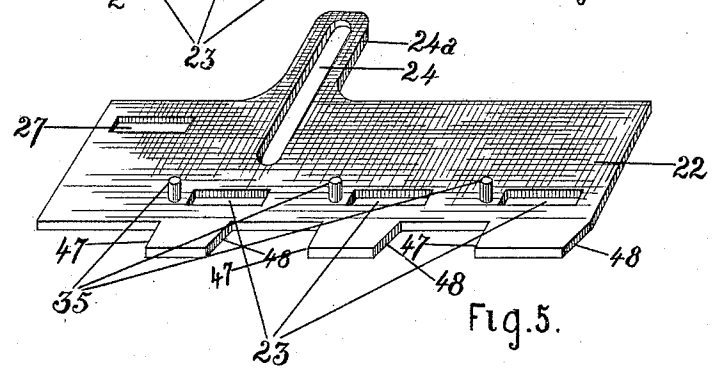

Fig. 5.

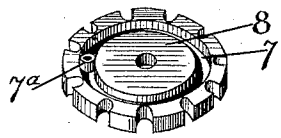

Fig. 6.

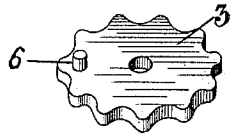

Fig. 7.

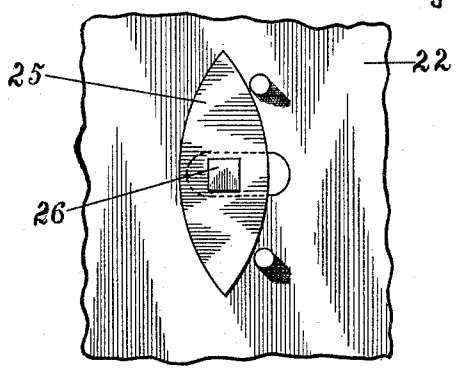

Fig. 9.

Witnesses.
James Pickburn
M. E. Angell.

Inventor.
Alfred C. Lawrence
by Chas. H. Riches
his attorney.

UNITED STATES PATENT OFFICE.

ALFRED C. LAWRENCE, OF TORONTO, ASSIGNOR OF ONE-HALF TO EDWARD J. WHEELER, OF PORT PERRY, CANADA.

COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 476,751, dated June 7, 1892.

Application filed August 1, 1891. Serial No. 401,408. (Model.)

To all whom it may concern:

Be it known that I, ALFRED C. LAWRENCE, printer, of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Combination-Locks; and I hereby declare that the following is a full, clear, and exact description of the same.

The object of this invention is to devise a lock by means of which the door can be securely fastened and opened only by those knowing the combination; and it consists, essentially, of the device hereinafter more fully set forth, and more particularly pointed out in the claims.

In the drawings, Figure 1 is a plan view of my improved lock with the outer or upper casing removed, showing the locking-bolt partly in section, the arrangement of the pawls, tumblers, and registering-plates. Fig. 2 is a view of the opposite side to that shown in Fig. 1 with the casing removed, showing the registering-plates and dials on the registering-plates and means for locking the registering-plates in their adjusted position. Fig. 3 is a view similar to Fig. 1, showing the slots in the tumblers in alignment, so that the locking-bolt can be thrown back. Fig. 4 is a sectional view on the lines $x\,x$, Fig. 3. Fig. 5 is a perspective view of the locking-bolt looking at it from the under side. Fig. 6 is a perspective view of the registering-plates. Fig. 7 is a perspective view of one of the circular tumblers. Fig. 8 is a plan view showing the locking-bolt thrown back. Fig. 9 is an alternative form of cam for moving the locking-bar backward.

Like numerals and letters of reference refer to like parts throughout the specification and drawings.

The casing of the lock consists of a rectangular-shaped frame composed of an inner side piece 1, outer side piece 1^a, end pieces 1^b, top and bottom 1^c. In the inner side piece 1 are formed the required number of openings 2, which in this instance are semicircular-shaped and correspond in number with the number of tumblers 3. Each of the tumblers 3 is circular in form and has formed on its periphery eleven teeth and ten intervening spaces. Extending inwardly from the periphery toward the hub of each tumbler 3 between two of the teeth is a slot 10. Each of the tumblers 3 is rigidly journaled on a spindle 4, the lower ends of which pass through the registering-plates 8 and are journaled in bearings 5, formed at or near the center, from which the circumference of each of the circular openings 2 is struck.

The dial-plate 8 is of the same size as the tumblers 3 and has cut on its periphery the same number of teeth as are cut on the periphery of the tumblers 3, with a notch or space between each pair of teeth, into which engages the stop 12, shown to consist of a pin 9, rigidly fastened to the cover 13, closing the openings 2. On the lower or outer side of each of the registering-plates 8 is a dial 14, numbered consecutively from 1 to 0 with a blank space between the "0" and the "1."

The numbers and the blank on the dial 14 are placed one opposite each of the eleven spaces on the periphery of the registering-plate 8. The spaces on the registering-plate correspond space per space with the spaces on the tumblers 3.

On the side of the tumblers 3 adjacent to the registering-plate 8 is a stop 6, which works in the circular guideway 7, formed in the side face of the registering-plate 8, adjacent to the tumbler 3. In the guideway 7 is a stop 7^a, which stops the travel of the tumbler at that point when moving in either direction.

The spindle 4 extends from the tumbler 3 upwardly and outwardly through the locking-bolt 22, the recoil-drum 16, and the outer side 1^a of the casing and has rigidly secured to its outer end a knob 17. Each of the spindles 4 is fitted with a T-pin 18, with which engages the slot 20, formed in the hub 19 of the recoil-spring drum 16. Wound on each of the drums 16 is a recoil-spring 21, one end of which is securely fastened to said drum and the opposite end fastened to the bottom 1^c or other convenient part of the casing of the lock.

The stop 7^a in the guideway 7 should in all cases be placed opposite the space indicated by the blank space.

The locking-bolt is a piece of metal rectangular in shape provided with an elongated slot 23 for each of the spindles 4 of the tumblers 3 to pass through. The locking-bolt is also provided with an outwardly-extending arm 24^a, in which is formed a straight slot 24, with which engages the cam 25, operated by the knob-stem 26. This slot, as shown in the drawings, extends nearly the entire length of the arm 24^a and partially across the width of said locking-bolt. The locking-bolt 22 is furthermore provided with an elongated slot 27, through which passes the pin 28, fastening the latch 29 to said bolt. On the locking-bolt 22 to the rear of its middle portion is a pin 30, with which engages the straight arm 31 of the spring 32, coiled on a pin 33, secured to the lower side 1 of said casing, said spring 32 being provided with a second arm 34, which lies against the bottom 1^c of said casing.

On the under side of the locking-bolt 22 and in alignment with each other is a series of pins 35, located one in front of the middle of each of the slots 23, acting as male wards to engage with the slots 10 in the tumblers 3, said slots 10 acting as the female wards.

Pivoted to the lower or inner side piece 1 is a double-acting pawl 36, one end of which engages with the spaces on the periphery of the circular tumbler 3. This pawl consists of a U-shaped arm 37, pivoted at one end 38 to a bearing 39, formed on the inner side piece 1. At the elbow or bend of the arm 37 is a notch 41, into which engages the notched end 42 of the pawl 43, pivoted to said bearing 39, so that the said notched end 42 will engage with the notch 41 at said elbow. The opposite end 44 of said pawl 43 engages with the spaces on the periphery of the tumbler 3 toward the rear end of the lock. The end 40 of the pawl 37 is provided with an upwardly-extending pin 45, which engages with a stop 47 on the locking-bolt 22, and the end 44 of the pawl 43 is provided with an upwardly-extending pin 46, which engages with a cam 48, formed on the edge of the locking-bolt 22.

The locking-bolt when it is thrown backward into the position shown in Fig. 8 moves the pawl 43 out of the spaces on the periphery of the tumbler 3 by means of the cam 48 moving the pin 46 outward. When the locking-bolt moves the pawl 43 out of the spaces on the tumbler 3, the notched end 42 of said pawl engages with the notch 41 on the pawl 37. Said pawl 43 is locked into its open position by means of the engagement of said notches, and it remains in that position until the locking-bolt has traveled forward again and moved the pawl 37 outward by means of the stop 47, engaging with the pin 46. As the end 44 is moved out the notch 41 is also moved outward and clear of engagement with the notched end 42 of the pawl 43, allowing the returning-spring 49 to throw the end 44 of the pawl 43 again into the spaces on the periphery of the tumblers.

The end 38 of the pawl 37 is provided with a bearing-surface 50, against which the spring 49 bears. The spring 49, bearing on the surface 50 when moved backward by the action of the cam 48, moves said end 38 in the same direction, causing the end 40 to move toward the tumbler 3 and the notch 41 to engage with the notched end 42 of the pawl 43.

The latch 29 is arranged so that it is free to slide in the elongated slot 27, so that the door may be opened from the inside without the necessity of having to bring the slots 10 into alignment to throw the locking-bolt back into the opened position shown in Fig. 8.

In Fig. 9 I have shown an alternative form of cam 25, operated by a door-knob stem 26. This consists of a cam-face in the form of an ellipse bearing against two pins arranged at an angle of fifteen degrees to the horizontal diameter of the pivot of said cam.

In Fig. 3 I have shown a means for locking the tumblers into their opened or closed position. In Fig. 3 I have shown the slots in the tumblers locked in their opened position. This means consists of three fingers $a\ a\ a$, joined together by means of an arm A, provided with elongated slots b, arranged at right angles to the line joining the centers of the tumblers 3, connected to a knob-stem c. By moving the arm A forward until the fingers $a\ a\ a$ engage with the spaces on the periphery of the tumblers 3 the tumblers are so locked that it is impossible for them to move or alter their position. The stop 7^a in the guide-way 7 is located at the same point in each of the registering-plates 8, and the dial 14, with the numbers arranged on its outer side, is arranged in the same relation to the stop 7^a in each registering-plate, so that a person by setting the dial at a certain point can regulate the number of spaces each tumbler has to be turned before the slots 10 are brought into alignment with the pin 35.

Having thus fully described the mechanical construction of the device, I will now endeavor to explain the operation of the same.

The recoil-spring 21, wound on a drum 16, provided with hubs 19, engaging with the T-pin 18 on the spindle 4, returns each of the tumblers to their rear or normal position—that is, each tumbler is turned until the stop 6 engages with the stop 7^a in the guideway 7. We will suppose that the dial-plate on the tumbler marked x indicates "3," that the dial-plate on the tumbler marked y indicates "8," and that the dial-plate on the tumbler marked z indicates "2." It will now be necessary to turn the tumbler marked x around three spaces, the travel of which is indicated by the pawl 43 dropping into each space in the revolution. It will be necessary to turn the tumbler marked y around a distance of eight spaces, the travel of which is indicated as before mentioned, and to turn the tumbler marked z around a distance of two spaces, when the slots in each of said tumblers will be brought into alignment. As soon as the tumblers have been turned their regulated distance the slots 10

are brought into alignment and it is possible by turning on the door-knob stem 26 to move the locking-bolt 22 backward, which in its backward travel carries the latch 29 with it, thus unlocking the door. The object of the pawl 43 is to indicate by sound the number of spaces which each tumbler has been turned, and also to hold the tumbler in its turned position, and the object of the pawl 37 is to hold the pawl 43 in its opened position while the locking-bar is turned back and until the tumblers have been returned to their normal or starting position by the action of the recoil-spring 21. When the locking-bar 22 has traveled forward, it moves the pawl 37 outward, which in its outward movement releases the pawl 43 and allows it to fall into the notches.

It is possible to construct a lock with any required number of tumblers and to set these tumblers at any combination, making it an utter impossibility for any one not knowing the combination to throw back the locking-bolt and open the door from the outside. By having the elongated slot 27 in the locking-bolt it is possible from the inside of the door to move the latch back independent of the locking-bolt; but from the outside of the door it is absolutely necessary that all the slots in the tumblers should be in alignment before the locking-bolt can be moved backward, the pin on the locking-bolt bringing said locking-bolt to a stop the instant it strikes against the tumbler. By providing the means for locking the tumblers into an open or closed position it is possible for any one not knowing the combination to open the door from either side or to prevent any person opening it at all, even supposing he knows the combination.

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

1. A lock consisting of a series of tumblers having formed on their peripheries a series of notches and a slot extending from the periphery inward toward the hub, a registering-plate having formed in it a circular guide-way in which is located a stop, a stop on the side of the tumbler running in the said guideway and adapted to impinge against said stop, a double-acting pawl to engage with notches on the edges of said tumblers, a locking-bolt provided with a series of stops to engage with the slots in said tumblers, means for bringing said slots into alignment and indicating the fact, and means for throwing the locking-bolt backward, substantially as described.

2. A lock consisting of a series of tumblers, each of which has formed on its periphery a series of spaces and a slot extending from said periphery inward toward the hub, a two-part pawl engaging with spaces on the peripheries of said tumblers to hold the tumblers while in their closed position and to indicate by sound the distance each tumbler has been turned, a stop on one of the side faces of each of said tumblers, a registering-plate having a circular guideway in the side face adjacent to said tumbler, in which moves the stop on said tumbler, a stop in said guideway with which the stop on said tumbler comes in contact, a locking-bolt provided with a series of lateral stops, which engages with the slots of said tumblers, means for setting said tumblers to different combinations and turning the slots into alignment, and means for throwing the locking-bolt backward when said slots are in alignment, substantially as described.

3. A lock consisting of a locking-bolt, a series of tumblers controlling the movement of the bolt, means for operating said tumblers, a locking-arm arranged below the tumblers and provided at its upper end with fingers adapted to engage the recesses of the tumblers, and means for operating said locking-arm.

4. In a lock, in combination, with the tumblers, a double-acting pawl consisting of a branched pivoted arm at one end to some convenient portion of the casing and provided on the inner side of the elbow with a notch which engages with a notch formed on the pivoted end of the pawl, the outer end of said pawl engaging with a series of notches formed on the periphery of said tumblers, substantially as described.

5. In a lock, the combination of a tumbler having formed on its edge a series of notches and a slot extending from the periphery inward toward the hub, a stop on one of the side faces of said tumbler, a registering-plate journaled on the same spindle as said tumbler is journaled on and having formed in its side face adjacent to said tumbler a guideway in which works said stop on the side face of said tumbler, a stop in said guideway with which the stop of said tumbler comes in contact, a dial on the outer face of said registering-plate, and means for locking said registering-plate into any adjusted position, substantially as described.

6. In a lock, a series of circular-shaped tumblers each of which has formed on its periphery a suitable number of notches and a slot extending from the periphery inward toward the hub, a stop formed on one of its side faces engaging in a circular guideway formed on the side face of the registering-plate adjacent to said tumblers, a stop in said guideway with which a stop on said tumbler comes in contact, said registering-plate and tumbler journaled on the same spindle, the tumbler rigidly fastened to the spindle and the registering-plate loosely journaled thereon, a dial on the outer side of said registering-plates, a series of notches on the peripheries of said registering-plates, said notches of equal pitch and corresponding in number with the number of numerals on said dial, and means for setting said registering-plates to any desired combination, means for bringing the slots in the tumblers into alignment and announcing by sound that fact, a locking-bolt provided with a series of stops to engage with the slots of said tumbler

when said slots are in alignment, and suitable means for throwing said locking-bolt backward, substantially as described.

7. A lock consisting of a series of tumblers circular in form and each having a notched periphery and a slot extending inward, a branched arm pivoted at one end to a suitable bearing and having a notch at the inner side of its elbow, said notch engaging the notched end of a pawl which is pivoted at said notched end and has its free end engaging with a space on the periphery of said tumbler, and a locking-bolt provided with stops engaging with the slots in the tumblers when in alignment.

8. In a lock, a series of tumblers having notched peripheries and slots extending from the peripheries inward toward the hubs, branched arms pivoted at one end and provided with notches on the inner sides of their elbows, pivoted dogs having notched ends which engage the notches in the branched arms and having their free ends adapted to engage the notched peripheries of the tumblers, a locking-bar provided with a series of stops to engage the slots in the tumblers, registering-plates adjacent to the tumblers provided with guideways on their side faces, stops on the tumblers moving in said guideways, stops in said guideways to limit the movement of the tumblers, dials on the outer faces of the registering-plates, said registering-plates having notched peripheries corresponding to the notched peripheries of the tumblers, pins engaging the peripheries of the registering-plates, means for bringing the slots in the tumblers into alignment, and means for throwing the locking-bolt backward.

Toronto, June 16, 1891.

ALFRED C. LAWRENCE.

In presence of—
CHARLES H. RICHES,
M. E. ANGELL.