Aug. 12, 1947. A. C. SANOWSKIS 2,425,646

COMBINATION LOCK

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Fig. 1

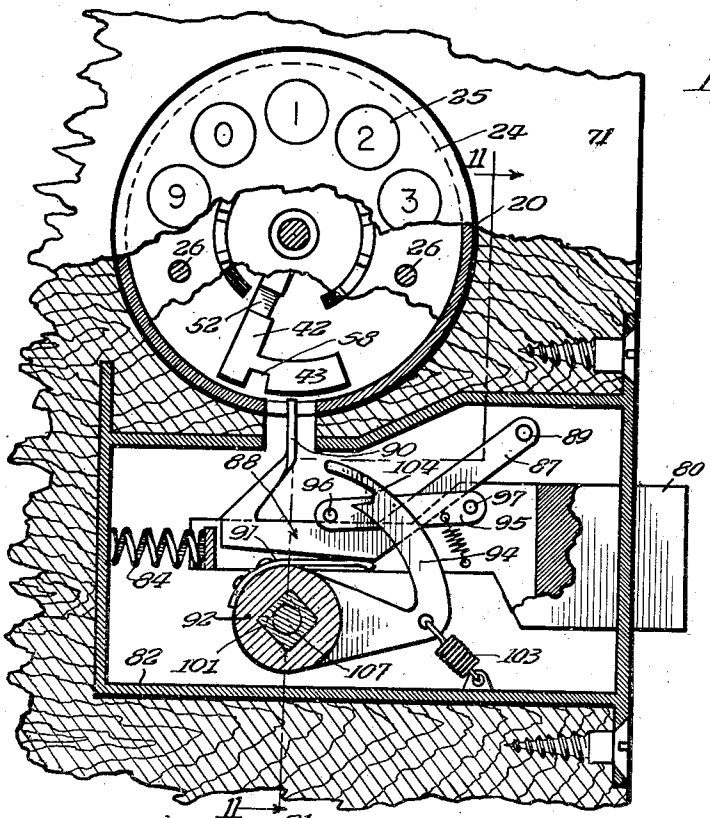

Fig. 2

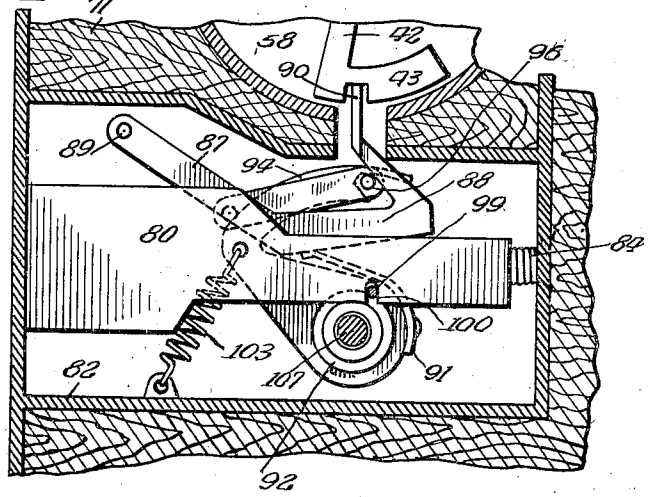

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FIG. 3

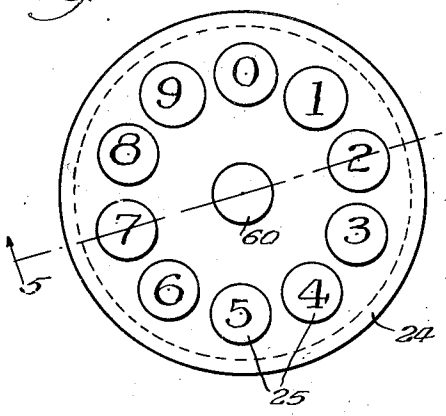

FIG. 4

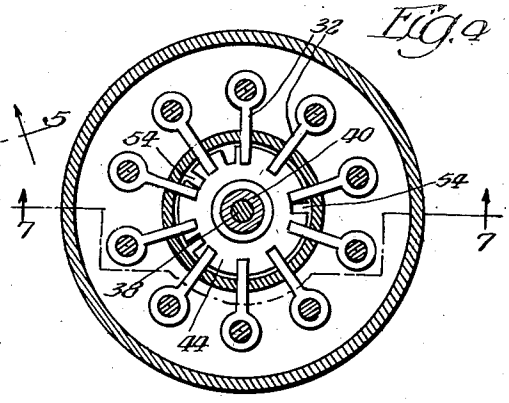

FIG. 5

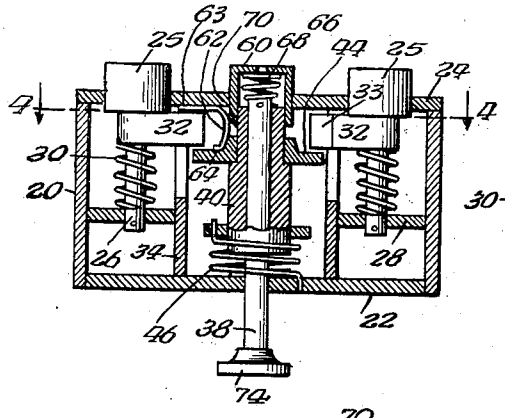

FIG. 7

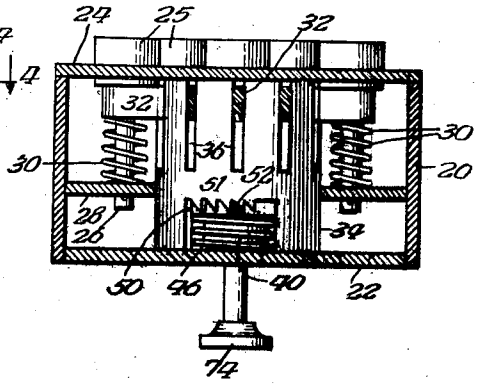

FIG. 6

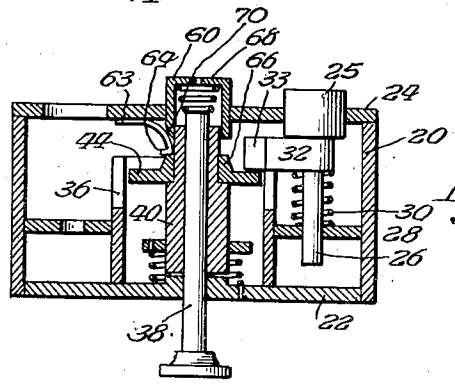

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Fig. 8

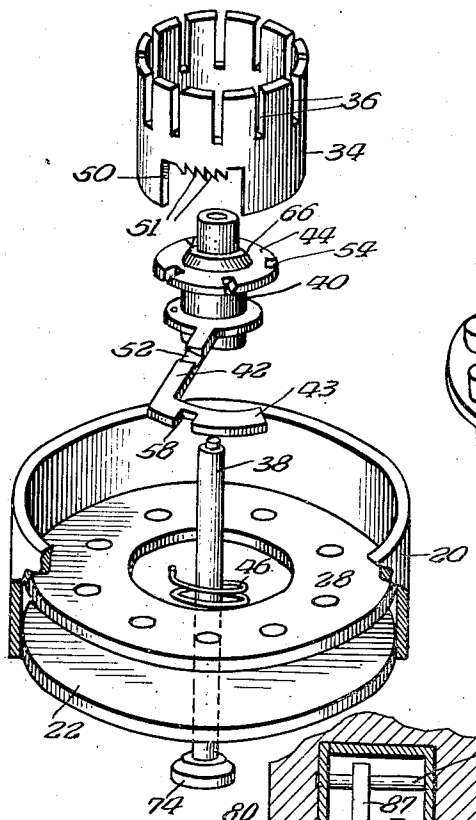


Fig. 10

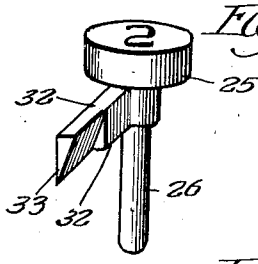


Fig. 9

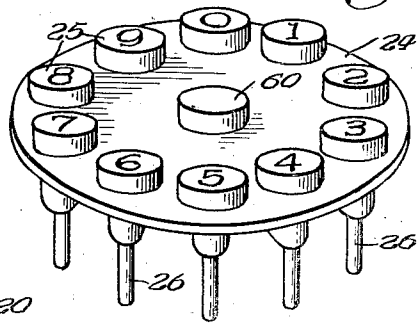
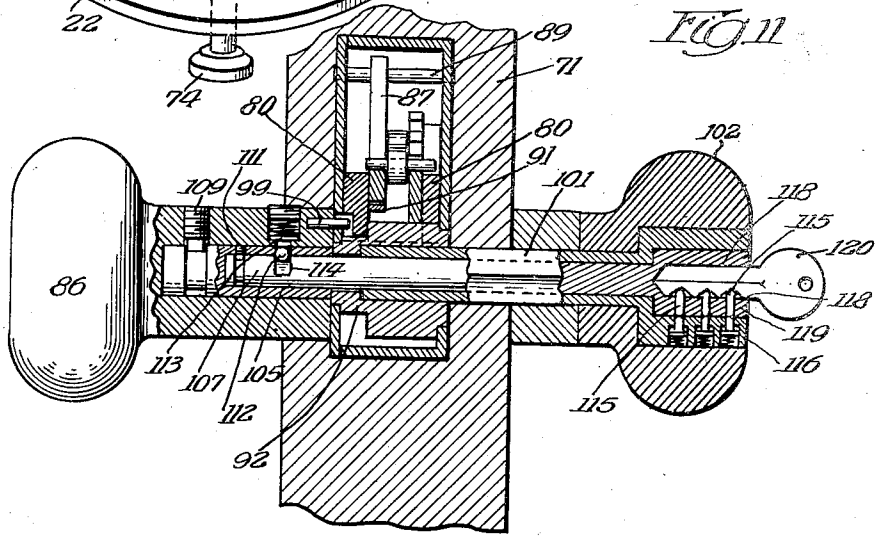


Fig. 11



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UNITED STATES PATENT OFFICE

2,425,646

COMBINATION LOCK

Albert C. Sanowskis, Chicago, Ill.

Application January 19, 1946, Serial No. 642,289

15 Claims. (Cl. 70—313)

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The invention relates to combination locks.

One object of the invention is to provide an improved combination lock of the type which is controlled by a set of keys or buttons.

Another object of the invention is to provide a combination lock in which the combinations may be readily varied by substitution of a single disk.

Another object of the invention is to provide a combination lock which is simple in construction and may be economically produced.

Other objects of the invention will appear from the detailed description.

The invention consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is an outer side elevation of a combination lock applied to control a locking bolt for a door, parts being broken away and shown in section for illustrative purposes, the locking bolt being shown in its locking position.

Fig. 2 is a similar view, as seen from the inner side of the door, of the locking bolt in its retracted position.

Fig. 3 is an outer face view of the combination lock.

Fig. 4 is a section taken on line 4—4 of Fig. 5.

Fig. 5 is a section taken on line 5—5 of Fig. 3.

Fig. 6 is a similar section, illustrating the control disk locked in its inoperative position as the result of the operation of one of the keys which is not within the correct combination, the key at one side being omitted.

Fig. 7 is a section taken on line 7—7 of Fig. 4.

Fig. 8 is a perspective of parts of the combination lock, disassembled for illustrative purposes.

Fig. 9 is a perspective of the cover-plate and the push-buttons carried thereby.

Fig. 10 is a perspective of one of the push-buttons or keys.

Fig. 11 is a section taken on line 11—11 of Fig. 1 of locking mechanism for a door, which is also controlled by the combination lock.

The invention is exemplified in a combination lock, the operative parts of which are mounted in a cylindrical casing 20, for controlling the operation of a bolt for locking a door. The inner end of the casing is closed by a wall 22 and the outer end has fixedly secured thereto a cover-plate 24. An annular series of keys or buttons 25 bearing numerals ranging from "0" to "9" are slidably guided in the cover-plate 24 and provided with stems 26, the inner ends of which are slidably guided in an annulus 28 which is fixed in the cylindrical casing 20.

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A coil spring 30 is placed around each stem for pressing the keys 25 individually and yieldingly into and retracting them to their normal outer position. Each key has affixed thereto an arm 32 which extends radially inward from its stem 26 and is provided with a downwardly tapered or wedge-shaped inner end 33. A cylindrical guide 34 is coaxially disposed in the cylindrical casing and fixedly secured therein and provided with an annular series of longitudinally extending slots 35 in which the arms 32 are respectively slidably guided.

A unit, which is operable by the wedge-shaped inner end 33 of arms 32, is mounted for oscillation in the case around a shaft 38. The unit comprises a sleeve 40, which is rotatable around the shaft 38, a lock-controlling arm 42 which is provided with an arcuate outer end or terminal 43, and a disk 44, which are fixedly secured together for conjoint oscillation. A compression and torsion spring 46 is applied between the innerwall 22 of the case and arm 42 for permitting inward sliding movement of the unit on shaft 38 and for urging the unit in counter-clockwise direction. The cylindrical guide 34 is provided at its inner end with a cutaway portion or notch 50 between the ends of which the lock-controlling arm 42 is movable. At the inner end of notch 50 the cylindrical guide 34 is provided with a series of ratchet teeth 51 corresponding in number to the number of units in the operative combination for the lock. The compression moment of spring 46 yieldingly urges arm 42 into engagement with ratchet teeth 51. Arm 42 is provided with a cut-away forming a ratchet tooth 52 which is engageable with the ratchet teeth 51 on the cylindrical guide 34 and is adapted to permit step-by-step rotation of the unit, including arm 42 in counter-clockwise direction and to be held in its stepped rotative positions by ratchet teeth 51. The unit, including sleeve 40, disk 44 and arm 42, is slidable inwardly on shaft 38 for successive engagement of tooth 52 on arm 42 with the ratchet teeth 51 against the compression moment of spring 46 and is movable inwardly on shaft 38 for disengagement of tooth 52 and arm 42 from ratchet teeth 51 for the retraction of the unit by torsional force of spring 46.

Disk 44 is provided with a series of peripheral notches 54 into which the wedge-shaped ends 33 of arms 32 on buttons 25 are adapted to pass for rotating the unit, including said disk, sleeve 40 and arm 42, step-by-step in counter-clockwise direction. Notches 54 are circumferentially arranged so they will be successively entered by the

wedge-shaped ends 33 to rotatively advance the disk 44, if the buttons 25 bearing the correct numbers of the combination are successively depressed in the proper sequence. The disk shown is adapted for a five unit combination and provided with five notches 54 which are circumferentially spaced for the entry of selected wedge-shaped ends 33 on arms 32, in predetermined succession. Each wedge-end 33 of an arm 32 is adapted to shift the disk 44 and arm 42 one step. When the lock-controlling arm 42 has been shifted five steps in counter-clockwise direction, its segmental end 43, which is provided with a notch 58, will be positioned so that said notch will permit the operation of the locking-bolt hereinafter described.

Mechanism is provided for resetting the combination lock to its normal position and this comprises a cup-shaped button 60 which projects through and is slidable in cover-plate 24 around the outer end of sleeve 40.

A flat spring 62 has one of its ends 63 fixed to the under side of cover-plate 24 and its other end or terminal 64 is adapted to abut against the tapered periphery of a ring 66 which is provided with a flat outer end. Button 60 when pressed will shift sleeve 40 and arm 42 longitudinally and disengage tooth 52 on arm 42 from ratchet teeth 51 for rotative retraction of said sleeve and arm to their normal position. The inner end of reset button 60 is adapted to shift sleeve 40 inwardly to release arm 42 from ratchet teeth 51 to permit spring 46 to oscillate arm 42 and disk 44 into their normal position. Button 60 is connected to the outer end of shaft 38 by a coil spring 68 which has its ends fixedly secured to said shaft and said button.

Terminal 64 of spring 62 is adapted to snap over the flat outer end of ring 66 if disk 44 is shifted inwardly by its engagement of one of the arms 32 and to retain arm 42 disengaged from ratchet teeth 51. Reset button 60 is provided with a cam 70 which is adapted to engage the inner end of spring 62 for pressing terminal 64 of spring 62 radially outward to release disk 44 for engagement of arm 42 with ratchet teeth 51 when button 60 is operated, if disk 44 has been longitudinally shifted inwardly by a button which is not the correct key in the combination. The shaft 38 extends through the inner side door and is provided with a button 74 at the inside of the door for operating the resetting button 60 to release the unit, including disk 44, sleeve 40 and arm 42, for retraction to its normal position by spring 46.

The operation of the combination lock will be as follows: assuming the combination consists of numerals "2," "8," "3," "0," "9," the operator will push button "2" and the wedge-end 33 of its arm 32 will enter notch 54, which is then positioned so the disk 44, sleeve 40 and arm 42 will be rotated one step in counter-clockwise direction. Tooth 52 on arm 42 will then slip into engagement with the left-hand ratchet tooth 51 and arm 42 will be retained in its shifted position. This movement of disk 44 will change the rotative position of the remaining notches 54 relatively to arms 32 and rotate said disk to bring another notch 54 into position for movement of another step only by the arm 32 of the "8" button. When button "2" is released, it will be retracted by its spring 30. Arm 42 will then be engaged and held by the second ratchet tooth 51. If the "8" button is next pressed, its arm 32 will enter the notch 54 which has been rotated into operative relation therewith and the disk will be shifted another rotative step. This will bring another notch 54 into operative relation with only the arm 32 on the "3" button and cause arm 42 to be latched by the third ratchet tooth 51. When button "8" is released, it will be retracted and disengaged from disk 44. A notch 54 will then be positioned in operative relation with only the arm 32 on the "0" button and arm 42 will be engaged with and latched by the fourth ratchet tooth 51. If the "0" button is next pressed, disk 44 will be rotated another step and arm 42 will be engaged and latched by the fourth ratchet tooth 51. This rotative step will position a notch 54 in operative relation with only the arm 32 on the "9" button. If the "9" button is then depressed, disk 44 will be shifted another step and arm 42 will be latched by the fifth ratchet tooth 51. This step-by-step rotation of disk 44 and lock-controlling arm 42 will position the notch in arm 42 to permit the door locking bolt hereinafter described to be unlocked.

If any button 25 is pressed except the correct one or in the sequence of the combination, its arm 32 will strike the outer face of disk 44 and slide said disk, sleeve 40 and arm 42 inwardly against the compression force of spring 46. The end 64 of flat-spring 62 will then snap over the outer end of ring 66 and hold disk 44, sleeve 40 and arm 42 so that tooth 52 of arm 42 will clear ratchet teeth 51 and the torsion of spring 46 will rotate the unit in clockwise direction until arm 42 abuts against the left-hand end of notch 50. Arm 42 will be held disengaged from the ratchet teeth 51 by spring 62. In this manner, the pressing of the incorrect button or in its incorrect sequence, will fail to shift arm 42 a rotative step. Arm 42 will remain disengaged from ratchet teeth 51 of cylindrical guide 34 until the resetting button 60 is pressed. When the resetting button 60 is pushed inwardly, its cam-surface 70 will engage the spring 62 and disengage the terminal 64 from ring 66 and permit arm 42 to be pressed by the compression force of spring 46 into engagement with the first ratchet tooth 51 of the series. In this manner, the pressing of any button 25, except the correct one and in the predetermined sequence, will render the combination lock inoperative to release the lock-controlling arm 42 until the combination lock is reset to its normal position.

The casing of the combination lock is secured in a door 71 and arm 42 controls a locking bolt or latch 80, as illustrated in Figs 1 and 2. Bolt 80 is slidably mounted into a case 82 which is set into the door. Said bolt is normally pressed into its locking position by a spring 84 in said case. A knob or handle 86 is disposed at the inner side of the door. A pin 99 on the inner end of the shank of knob 86 extends into a slot 100 in one side of bolt 80 for slidably shifting said bolt when said knob is turned. This permits the bolt 80 to be retracted from the handle on the inside of the door independently of the combination lock.

The mechanism which is controlled by the combination lock, for retracting bolt 80, comprises a handle or knob 102 on the outer side of the door which is fixed to a square shaft 101; a sleeve 92 which is journalled in the sides of case 82, and rotatable by shaft 101; a flat resilient strip 91 which has one of its ends fixed to the periphery of sleeve 92; an angular lever 87 which is fulcrumed at 89 in the case 82 and has a member 88 slidably engageable by strip 91 and a terminal 90

adapted to be arrested by the arcuate terminal 43 of arm 42 of the combination lock, and to enter notch 58 in said terminal, for controlling the retraction of bolt 80 by the outside handle 102; an arcuate arm 94 rigid with sleeve 92; and a link 95 which is pivoted at 97 to bolt 80 and carries a cross-pin 96 which rides on the upper edge of a portion of lever 87 and is adapted to be engaged by an abutment 104 on arm 94, for retracting the bolt 80. A spring 103 is adapted to retract arm 94.

In operation, when arm 42 is rotatively positioned with its notch 58 out of registry with terminal 90 of lever 87, the latter will be locked against pivotal movement by the rotation of sleeve 92 and resilient strip 91 so that turning of the outside handle 102 will not retract bolt 80. When notch 58 in arm 42 is positioned to receive terminal 90 of lever 87, the handle 102 can be turned for rotation of shaft 101, sleeve 92 and arm 94. The strip 91 will swing lever 87 upwardly so its terminal 90 will enter notch 58 in arm 42. The lever 87 will lift pin 98 into the path of abutment 104 on arm 94 when continued turning movement of handle 102 will shift link 95 and retract bolt 80 against the force of spring 84.

In some instances, it is desirable to provide for retracting bolt 80 by a key-controlled lock from the outer side of the door by means for turning the inner handle 86 which is adapted to retract bolt 80. The shank of handle 86 is rotatably mounted on a sleeve 105 and is held against longitudinal movement on said sleeve by a screw 109 which extends into an annular groove in said sleeve. A shaft 107 extends through shaft 101 and into sleeve 105 and is held against longitudinal movement by a screw 111 which extends into an annular groove in shaft 107. A ball 112 is confined in sleeve 105 and extends into a cam-groove 114 in shaft 107. A spring-pressed stud 113 in the shank of handle 86 presses ball 112 against its seat in cam-groove 114 so that handle 86 will be free to rotate on sleeve 105 when said handle is turned around sleeve 105. When shaft 107 is turned, the cam-groove 114 will force ball 112 outwardly to lock the shank of handle 86 and sleeve 105 for rotation by shaft 107. A cylinder-lock in outer handle 102 comprises a barrel 116 which is integral with shaft 101, a key-slot 118 in the outer end of a plug 119 which is integral with shaft 107, and pin tumblers 115 which are spring-pressed and adapted to normally lock barrel 116 and plug 119 against relative rotation and to be operated by a key 120 to release shaft 107 for rotation independently of handle 102. When arm 42 of the combination lock is set to prevent retraction of bolt 80 by rotation of outer handle 102 and key 120 is inserted in the key-slot 118, the tumblers 115 will be shifted to release shaft 107. When the key has been inserted and is turned, it will rotate shaft 107 which will cam ball 112 outwardly so it will lock sleeve 105 and handle 86 for conjoint rotation, and after thus shifting the ball 112, the end of cam-groove 114 will engage said ball and rotate handle 86 which carriers the pin 99 which is adapted to retract bolt 80.

The invention is not to be understood as limited to the details described, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A combination lock comprising: an annular series of slidably mounted selectively operable keys, shifting elements individually operable by the keys, mechanism operable step-by-step by predetermined sequential operation of the keys and the shifting elements, lock-controlling means operable by said mechanism, spring-means for retracting said mechanism, and means for releasing the mechanism for retraction by the spring-means and resetting said mechanism.

2. A combination lock comprising: an annular series of slidably mounted selectively operable keys, shifter arms individually operable by and extending radially inward from the keys, a cylindrical guide provided with slots for said arms, mechanism operable step-by-step by predetermined sequential operation of the arms by the keys, lock-controlling means operable by said mechanism, and means for retracting and resetting said mechanism.

3. A combination lock comprising: a series of slidably mounted selectively operable keys, shifting elements individually operable by the keys, a member provided with means whereby it can be shifted step-by-step by predetermined sequential operation of the elements by the keys, a spring retracted lock-controlling element shiftable step-by-step by said member from a normal position to lock-releasing position, ratchet means for holding the lock-controlling element in stepped positions, spring-means for retracting said member and the lock-controlling element to its normal position, and means for releasing the lock-controlling element and said member from the ratchet means for spring-pressed retraction to normal position.

4. A combination lock comprising: a series of selectively operable keys, shifting elements individually operable by the keys, a rotatable member provided with means whereby it can be shifted step-by-step in one direction from a normal position by predetermined sequential operation of the keys and the elements operable thereby, a lock-controlling element fixed to rotate with said member, ratchet means for holding said member and controlling element in their stepped positions, and means for resetting said member and controlling element in their normal position.

5. A combination lock comprising: a series of slidably mounted selectively operable keys, shifting elements individually operable by the keys, a rotatable and slidable member provided with means whereby it can be shifted step-by-step by predetermined sequential operation of the elements by the keys, a spring retracted lock-controlling element shiftable step-by-step by the rotatable member from a normal position to lock-releasing position and slidable with said member, a ratchet for holding the lock-controlling element in stepped positions, and means for slidably shifting the lock-controlling element and said member to release the controlling element from the ratchet when the predetermined keys are not pressed in correct sequential order.

6. A combination lock comprising: a series of axially slidable selectively operable keys, shifting elements individually and slidably operable by the keys, a rotatable member provided with means whereby it can be shifted step-by-step in one direction from a normal position by predetermined sequential operation of the keys and the elements operable thereby, a lock-controlling element fixed to rotate with said member, ratchet means for holding said member and controlling element in their stepped positions, and means

for resetting said member and controlling element in their normal position.

7. A combination lock comprising: a series of axially slidable selectively operable keys, shifting elements individually operable by the keys, a rotatable member provided with means whereby it can be shifted step-by-step in one direction from a normal position by predetermined sequential operation of the keys and the elements operable thereby, a lock-controlling element fixed to rotate with said member, ratchet means for holding said member and controlling element in their stepped positions, spring-means for retracting the rotatable member and the controlling element to normal position, and means for releasing the rotatable member and the controlling element for spring-pressed rotation to their normal position and resetting them.

8. A combination lock comprising: a series of axially slidable selectively operable keys, shifting elements individually and slidably operable by the keys, a rotatable and slidable member provided with means whereby it can be shifted step-by-step in one direction from a normal position by predetermined sequential operation of the keys and elements slidable therewith, a lock-controlling element fixed to rotate and slide with said member, ratchet means for holding said member and controlling element in their stepped positions, spring-means for rotatively retracting the rotatable member and controlling element to normal position for holding the controlling element engaged with the ratchet means, and means for releasing the rotatable member and the controlling element from the ratchet means for spring-pressed rotation and resetting them to normal position.

9. A combination lock comprising: a case, a series of selectively operable keys mounted to slide axially in the case, springs for retracting the keys, shifting elements on and slidable with the keys, respectively, a disk rotatable and slidably mounted in the case and provided with notches whereby it can be shifted step-by-step by predetermined sequential operation of the keys and the shifting elements thereon, a lock-controlling element fixed to rotate with the disk, ratchet means for holding the element and the disk in their stepped positions, and means for resetting the rotatable member and controlling element to their normal position.

10. A combination lock comprising: a case, a series of selectively operable keys mounted to slide axially in the case, springs for retracting the keys, shifting elements on and slidable with the keys, respectively, a disk rotatable and slidably mounted in the case and provided with notches whereby it can be shifted step-by-step by predetermined sequential operation of the keys and the shifting elements thereon, a lock-controlling element fixed to rotate with the disk, a ratchet for holding the element and the disk in their stepped positions, spring-means for rotatably retracting the controlling element and rotatable member to normal position, and slidably shifting the rotatable member to engage the ratchet, and means for releasing the controlling element from the ratchet for spring-pressed rotation to normal position.

11. A combination lock comprising: a case, a series of selectively operable keys mounted for axial sliding movement in the case, each provided with a stem and a shifter-arm, a disk rotatable and slidably mounted in the case and provided with notches adapted to receive the arms and whereby the disk can be shifted step-by-step by predetermined sequential operations of the arms on the stems of the keys, a lock-controlling element slidable and rotatable therewith, a ratchet stationary in the case, for holding the controlling element in stepped position, spring-means for yieldingly holding the element engaged with the ratchet and for rotatably retracting the arm and disk, and means for slidably releasing the element from the ratchet for retraction of the controlling element and disk to their normal position.

12. A combination lock comprising: a case, a series of selectively operable keys mounted for axial sliding movement in the case, each provided with a stem and a shifting arm having a wedge, a disk rotatable and slidably mounted in the case and provided with notches adapted to receive the wedges and whereby the disk can be shifted step-by-step by predetermined sequential operations of the arms on the stems of the keys, a lock-controlling arm slidable and rotatable therewith, a ratchet stationary in the case for holding the controlling arm in stepped positions, spring-means for yieldingly holding the arm engaged with the ratchet, and for rotatably retracting the arm and disk, and means for slidably releasing the arm from the ratchet for retraction of the controlling arm and disk to their normal position by the spring-means.

13. A combination lock comprising: a case, a series of selectively operable keys mounted for axial sliding movement in the case, each provided with a stem and an arm having a wedge, a disk rotatable and slidably mounted in the case and provided with notches adapted to receive the wedges and whereby the disk can be shifted step-by-step by predetermined sequential operations of the wedges of the stems of the keys, a lock-controlling arm slidable and rotatable therewith, a ratchet stationary in the case for holding the arm in stepped positions, spring-means for yieldingly holding the arm engaged with the ratchet and for rotatably retracting the arm and disk, and means for slidably releasing the arm from the ratchet for retraction of the arm and disk to their normal position by the spring.

14. A combination lock comprising: a case, a series of selectively operable keys mounted for axial sliding movement in the case, each provided with a stem and a shifter-arm and wedge, a cylindrical guide in the case for said arms, a disk within the guide rotatable and slidably mounted and provided with notches adapted to receive the ends of the arms and whereby the disk can be shifted step-by-step by predetermined sequential operations of the wedges on the stems of the keys, a lock-controlling arm slidable and rotatable therewith, a ratchet on the guide for holding the arm in stepped positions, spring-means, inside of the guide, for yieldingly holding the arm engaged with the ratchet and for rotatably retracting the arm and disk, and means for slidably releasing the arm from the ratchet, for retraction to their normal position by the spring.

15. A combination lock comprising: a case, a series of selectively operable keys mounted to slide axially in the case, springs for retracting the keys, shifting elements on and slidable with the keys, respectively, a disk rotatable and slidably mounted in the case and provided with notches whereby it can be shifted step-by-step by predetermined sequential operation of the keys and the shifting elements thereon, a lock-controlling element fixed to rotate with the disk, a ratchet for holding the controlling element and

the disk in their stepped positions, spring-means for rotatably retracting the control element and rotatable member to normal position and slidably shifting the control element and rotatable member, means for slidably shifting the disk when the predetermined keys are not pressed in a predetermined sequential order, means for holding the controlling element so it will be inoperative by the keys, and means for resetting the controlling element and disk.

ALBERT C. SANOWSKIS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
427,131	Thompson	May 6, 1890
1,427,382	Heller	Aug. 29, 1922