

Feb. 17, 1925.

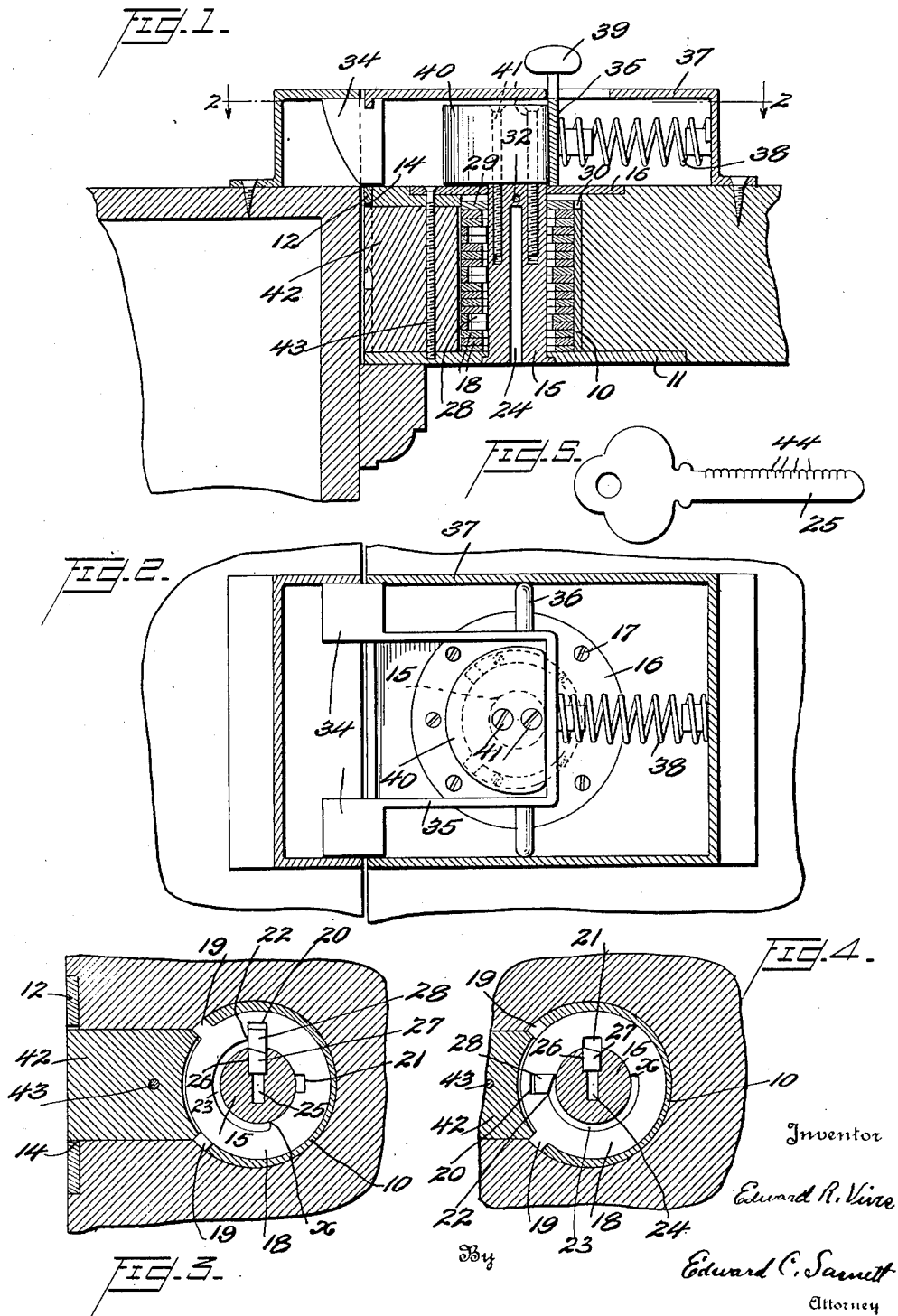
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E. R. VIVES

LOCK

Filed Aug. 21, 1923

2 Sheets-Sheet 1



Feb. 17, 1925.

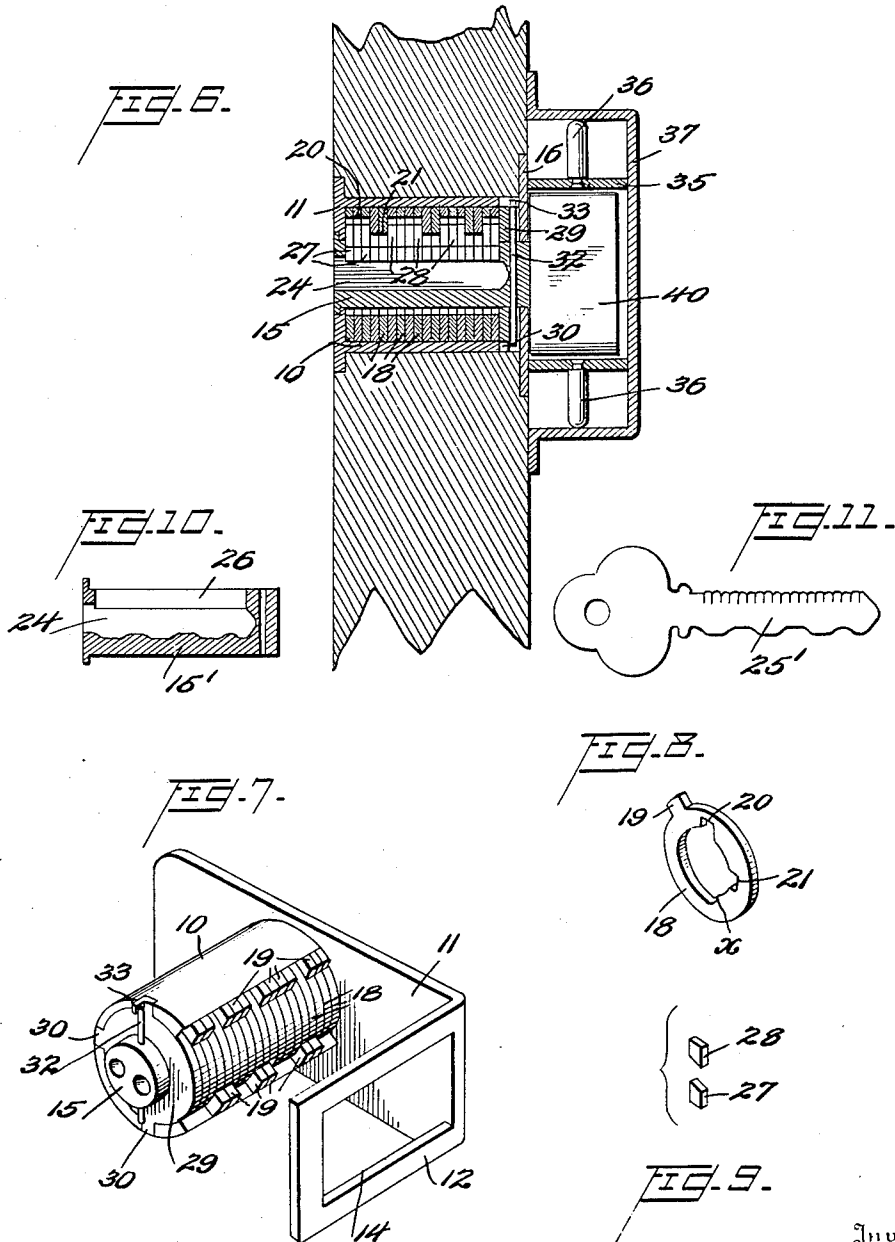
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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LOCK.

Application filed August 21, 1923. Serial No. 658,654.

To all whom it may concern:

Be it known that EDWARD R. VIVES, a subject of the King of Spain, and a resident of New York, in the county of New York and State of New York, has invented certain new and useful Improvements in Locks, of which the following is a specification.

This invention relates to combination locks of the multiple-key type or that type of lock in which the combination is adapted to be changed at will, each combination requiring a distinctive key.

The object of the present invention is to provide a combination lock in which the number of possible combinations is practically unlimited and in which the combination can be changed quickly and easily without disassembling the bolt operating and controlling mechanism. It is also an object of the invention to provide a lock of rugged and comparatively simple construction and having its elements designed to reduce the cost of manufacture to a minimum. Other objects and advantages of the invention will be set forth hereinafter.

Referring to the accompanying drawings for a particular description of a form of lock embodying the present invention:

Figure 1 is a sectional view through the bolt and controlling mechanism of the lock, this section being taken on a horizontal plane passing through the axis of the bolt controlling mechanism.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1, showing in elevation the bolt and the coacting end of the bolt controlling mechanism.

Figures 3 and 4 are vertical sectional views through the bolt controlling mechanism.

Fig. 5 shows a key form adapted to be converted into a key corresponding to any combination of the lock.

Figure 6 is a sectional view through the axis of the bolt controlling mechanism, taken at right angles to the section plane of Figure 1.

Figure 7 is a perspective view of the bolt controlling mechanism detached.

Figures 8 and 9 are perspective views of certain elements of the bolt controlling mechanism.

Fig. 10 is a longitudinal section of a modified form of key barrel.

Fig. 11 illustrates a key adapted to co-operate with the barrel shown by Fig. 10.

The present invention relates particularly to the combination, or bolt controlling, mechanism of the lock. Any suitable form of bolt or latch may be used in connection with this mechanism, so far as the present invention is concerned.

The bolt controlling mechanism is mounted in a cylindrical housing, or casing, 10, formed with or suitably attached to a plate 11. The door, or other closure, is provided adjacent its edge with a cylindrical aperture in which the casing 10 fits, the plate 11 being countersunk in the outer face of the door so as to lie flush therewith. Plate 11 has a right-angular extension 12 which extends across the edge of the door and is counter-sunk therein, as clearly shown in Figure 3. This extension has a rectangular opening 14 which registers with a slot formed in the edge of the door and extending to the cylindrical aperture in which casing 10 is fitted. As shown best in Figure 7, approximately 90° of the wall of casing 10 is cut away opposite the opening 14 and the slot in registry therewith.

Referring more particularly to Figures 1 and 6, plate 11 has a circular shouldered aperture disposed coaxially with casing 10, and rotatably mounted in this aperture is the flanged end of a barrel 15 which extends through the door and is rotatably mounted at its inner end in a plate 16 secured to the inner face of the door by screws 17. Loosely mounted on barrel 15 are a number of apertured disks, or wards 18 of the form shown in Figures 3, 4 and 8. All of these wards have the same form, each consisting of an apertured disk having a circular periphery adapted to fit the interior of casing 10 and having a lug 19 projecting radially therefrom in the space formed by the cut-away side of casing 10. Each disk has a pair of inwardly opening radial slots 20 and 21 separated approximately 90°. The radius of the aperture between the slots and from slot 21 to a point x is substantially equal to the radius of barrel 15, while from point x to slot 20 the radius is longer, thus forming

from point *x* an annular space 23 between shoulder 22 and slot 20. Slot 20 is shown deeper than slot 21, but this is not essential, and the slots may be of the same depth.

5 Barrel 15 has an axial key-way 24 adapted to receive a key 25, such as shown in Fig. 5 and also has a slot 26 which is wider than key way 24. The slot 26 is completely filled with tumblers 27 which rest on the ledges 10 formed at the junction of key way 24 and slot 26. The upper ends of the tumblers 27 are inclined and in normal position extend to the periphery of barrel 15, as clearly shown in Figs. 3 and 4. The tumblers 27 15 are all of the same form and are exactly equal in thickness to the wards 18, so that for each ward there is a tumbler 27 exactly coplanar therewith. In each slot 20 of the wards is a tumbler 28 which may be of the 20 same dimensions as tumbler 27, the two sets of tumblers, however, being disposed reversely so that the inclined ends thereof fit, as clearly shown in Figure 3. It will be understood therefore, that the slot 20 of each 25 ward has a tumbler 28 which is adapted to coact with a coplanar tumbler 27 in barrel 15. Figure 3 shows the normal position of the tumblers, and it will be observed that in this position the end of tumbler 28 projects slightly into the slot 26, preventing 30 rotation of the barrel in a counter-clockwise direction.

The wards may be retained in position by any suitable means. For this purpose, a 35 plate 29 is fitted over the inner end of barrel 15, the plate having a plurality of radially projecting lugs 30 which engage in notches cut in the inner end of housing 10. For preventing axial displacement of plate 40 29, a pin 32 is removably mounted in a diametrical hole formed in the end of barrel 15. In the normal angular position of the barrel, one end of pin 32 engages a lug 33 on plate 29, preventing rotation of the barrel 45 in a clockwise direction, looking at Fig. 3. It will be understood, therefore, that the barrel is normally held from rotation in either direction; in a counter-clockwise direction, by the engagement of one or more 50 tumblers 28 with the edge of slot 26, and in a clock-wise direction, by the engagement of pin 32 with lug 33.

Any suitable form of bolt or combined bolt and latch may be employed for locking 55 the door. I have illustrated in Figures 1, 2 and 6, a bolt consisting of two latch members 34 rigidly connected by an inwardly extending open rectangular frame 35 provided with laterally projecting guide pins 36 60 which engage the side walls of a housing 37 screwed on the inner face of the door. A suitable spring 38 between the end of frame 35 and the end wall of housing 37 normally holds the bolt projected. A finger piece 39 65 having a shank projecting through a slot in

housing 37 and secured to the end of frame 35 renders the bolt operable from the inside. A connection between the bolt and barrel 15 is provided consisting of a cam 40 fastened to the end of said barrel by 70 means of screws 41 tapped in the inner end of the barrel. Cam 40 is formed with a flat or straight portion which normally lies against the end of frame 35 and with cam 75 portions at each side of the straight portion, whereby the bolt is adapted to be operated by turning barrel 15 in either direction, to suit doors opening either to the right or to the left. In normal position the barrel is held by the coaction of cam 40 with 80 spring pressed bolt 35 in the position where pin 32 contacts lug 33, in which position the slot 26 in the barrel is in exact alignment with the slots 20 or 21 of the wards.

The combination of the lock is determined 85 by the relative angular positions of wards 18. When a ward is in the position shown in Figure 3, its slot 20 and tumbler 28 are opposite slot 26 in the barrel. In this position the tumbler 28 has gravitated to its 90 lowest position where it engages the edge of slot 26, preventing rotation of the barrel in a counter-clockwise direction. When a ward is turned through an angle of approximately 90° from the position shown in 95 Fig. 3, its lug 19 abuts the lower edge of the open side of casing 10 and its slots 21 comes into alignment with the slot 26 in the barrel, this position being illustrated by Fig. 4. With the ward in this position if 100 the tumbler 27 which is opposite slot 21 is raised slightly its end will project into slot 21, preventing rotation of the barrel in a counter-clockwise direction, looking at Figure 4. It will be clear, therefore, that in 105 order to rotate the barrel in a counter-clockwise direction, looking at Figures 3 and 4 (clock-wise looking at the outer end of the barrel), a key must be inserted which has its projections and spaces so arranged that 110 each tumbler 27 which is opposite a tumbler 28 will be raised and each tumbler 27 which is opposite a slot 21 will be unaffected. If a key having a combination of projections and spaces, which does not 115 correspond to the combination of the lock, is inserted, one or more tumblers 28 will not be raised and one or more tumblers 27 will be raised into engagement with a slot or slots 21, thereby preventing rotation of the 120 barrel. The number of wards may be varied in accordance with the number of possible combinations desired. I have illustrated a controlling mechanism provided with eighteen wards, which number provides 125 a practically unlimited range of combinations.

The wards are maintained in their set positions by means of a block 42, which is 130 formed to fit the slot in the edge of the

door in registry with the opening 14 of plate 12. The inner end of the block is curved to fit the peripheries of wards 18 between lugs 19, as clearly shown in Fig. 3, and the outer end of said block lies flush with the outer surface of plate 12. This block is removably held in position by means of a screw 43 which passes through the block and has its end tapped in a hole formed in plate 11, the head of said screw being countersunk in plate 16.

When it is desired to change the combination of the lock it is only necessary to unscrew bolt 43, remove block 42, and rotate one or more wards through an angle of 90°, or the angle limited by engagement of lug 19 with the opposite edges of casing 10. Block 42 is then replaced, holding the wards securely in their adjusted positions. Suitable finger recesses may be provided in the outer face of block 42 for its easy manipulation.

Of course when a new combination has been set up, a new key corresponding to the new combination is required. Fig. 5 shows a key form which can be converted with facility into a key corresponding to any combination within the range of the lock. This key form has a number of teeth 44 corresponding to the number of wards 18. The teeth have rounded ends adapted to cam under the tumblers 27 and are of sufficient length to raise tumblers 28 entirely out of slot 26 or to raise tumblers 27 into engagement with the edge of slot 21, as the case may be. It is only necessary to lift tumblers 27 a slight amount to effect their unlocking or locking action, and the teeth 44 therefore may be only a small fraction of an inch in length. The teeth are adapted to be easily broken off, and for this purpose they may be joined to the body of the key by a weakened, or reduced, portion, which, while of sufficient strength to withstand ordinary usage, yields to a force which can be exerted conveniently without the medium of special tools.

The combination for which the lock is set is readily ascertained, when block 42 is removed, by inspection of the angular positions of wards 18, as indicated by the positions of their lugs 19. In Figure 7, counting from the outermost ward, the first, second, third, sixth, seventh, eighth, ninth, twelfth, thirteenth, fourteenth, seventeenth and eighteenth wards have their lugs up, indicating that the slots 20 of these wards are opposite the slot 26 in the barrel; while the fourth, fifth, tenth, eleventh, fifteenth and sixteenth wards have their lugs down, indicating that the slots 21 of these wards are opposite the slot 26. To form a key for this combination from the key form illustrated by Figure 5, the fourth, fifth, tenth, eleventh, fifteenth and sixteenth tooth

should be broken off. Such a key when inserted in the key-way of the barrel will move all tumblers 28 out of engagement with barrel 15 and leave unaffected those tumblers 27 which are opposite the slots 21, thereby permitting rotation of barrel 15 to retract the bolt, it being noted that the space between the barrel and the wards and extending from point *a* to slot 20 permits rotation of the barrel when tumblers 27 are projected beyond the periphery of the barrel.

Of course it is not necessary to use up a key blank, such as shown in Fig. 5, for each change in the lock combination. On the contrary, a single key blank may be used for several different combinations, it being only necessary to break off the required teeth as the new combinations are set up. For example, suppose that the combination illustrated in Fig. 7 is changed by moving the first ward through the limited angle, the key which was formed to unlock the combination of Fig. 7 could be used for the new combination by simply breaking off its first tooth.

In Fig. 11 I have illustrated a key having an edge of irregular or undulating profile opposite the teeth and in Fig. 10, a barrel 15' having the bottom of its key-way 24 correspondingly undulated. Obviously, with this construction it is impossible to unlock the combination except with a key which not only has its teeth and spaces corresponding to the positions of the wards but also an undulating edge corresponding to the undulations in the bottom of the key-way. It is proposed to manufacture locks in accordance with this invention in several different numbers or forms of undulations and also of course key blanks with corresponding profiles. In such a system of locks it is desirable to identify the keys corresponding to the particular undulations of the several styles of locks. For this purpose the keys and locks will be formed with suitable identification marks, for example, the keys corresponding to a particular style of lock would be formed with a common number, which number would also be borne by the lock.

A lock of the above described construction possesses many features of superiority, among which may be mentioned, simplicity and ruggedness of construction, low cost of manufacture because of its relatively few and easily made parts, the large number of possible combinations, and the ease with which a new combination may be set up and with which a new key corresponding to such combination may be formed.

Now having particularly described a form of my invention without intending to limit the scope thereof, what I claim as new is:

1. In a lock of the kind described, bolt controlling mechanism comprising a barrel

having an axial key-way adapted when rotated to operate a bolt, a plurality of apertured disks mounted on said barrel each having two angularly spaced inwardly opening slots, a number of key-operable tumblers mounted for radial movements in said barrel corresponding to the number of said disks and coplanar therewith, each of said disks being rotatable through a limited angle to bring one or the other of its slots over and in alignment with the co-acting tumbler, and a tumbler in one of the slots of each disk adapted when the disk is in one position to rest on its coacting tumbler and engage said barrel to prevent rotation thereof, said disk in its other position having its other slot over said coacting tumbler so as to be engaged thereby when said tumbler is raised to prevent rotation of said barrel.

2. In a lock of the kind described, bolt controlling mechanism comprising a barrel having an axial key way adapted when rotated to operate a bolt, a plurality of members coaxial with said barrel each having two angularly spaced inwardly opening slots, a number of key-operable tumblers mounted for radial movements in said barrel corresponding to the number of said members and coplanar therewith, each of said members being rotatable through a limited angle to bring one of the other of its slots over and in alignment with the coacting tumbler, and a tumbler in one of the slots of each member.

3. In a lock of the kind described, bolt controlling mechanism comprising a barrel, a plurality of apertured disks loosely mounted thereon, all of said disks being of identical form and having two angularly spaced inwardly opening radial slots, said barrel having an axial key way and an axial slot of greater width communicating with said key way and opening through the side of said barrel, a number of tumblers in said axial slot corresponding to the number of said disks and coplanar therewith, each of said disks being rotatable on said barrel to bring one or the other of its slots over and in alignment with the axial slot in said barrel, a tumbler in one of the slots of each disk adapted to rest on its coacting tumbler in said axial slot and to project slightly into said slot.

4. In a lock of the kind described, bolt controlling mechanism comprising a barrel adapted when rotated to operate a bolt, a plurality of apertured disks mounted on said barrel each having two angularly spaced inwardly opening slots, said barrel having an axial key way and an axial slot communicating with said key way and opening through one side of the barrel, a number of tumblers in said axial slot corresponding to the number of said disks and coplanar therewith, each of said disks being rotatable through a limited angle to bring one or the other of its

slots over and in alignment with the coacting tumbler, and a tumbler in one of the slots of each disk adapted to rest on its coacting tumbler and to project slightly into said axial slot.

5. In a lock of the kind described, bolt controlling mechanism comprising a barrel having an axial key way adapted when rotated to operate a bolt, a plurality of apertured disks mounted on said barrel, all of said disks being of identical form and having two angularly spaced inwardly opening radial slots, a number of tumblers mounted for radial movements in said barrel corresponding to the number of said disks and coplanar therewith, each of said disks being rotatable through a limited angle to bring one or the other of its slots over and in alignment with the coacting tumbler, and a tumbler in one of the slots of each member adapted when opposite its coacting tumbler to engage said barrel and prevent rotation thereof.

6. In a lock of the kind described, bolt controlling mechanism comprising a barrel having an axial key way adapted when rotated to operate a bolt, a plurality of apertured disks mounted on said barrel each having two angularly spaced inwardly opening slots, the aperture of each disk having substantially the same radius as that of the barrel between said slots and to a point substantially beyond one of said slots and having a substantially greater radius from said point to the other slot, said barrel having an axial slot of greater width than said key way opening through the side thereof, a number of tumblers in said axial slot corresponding to the number of said disks and coplanar therewith, each of said disks being rotatable through a limited angle to bring one or the other of its slots over and in alignment with its coacting tumbler, and a tumbler in one of the slots of each disk adapted to rest on its coacting tumbler and project slightly into said axial slot.

7. In a lock of the kind described, bolt controlling mechanism comprising a barrel having an axial key way adapted when rotated to operate a bolt, a plurality of apertured disks of identical form mounted on said barrel each having two angularly spaced inwardly opening slots, a number of key-operable tumblers mounted for radial movement in said barrel corresponding to the number of said disks and coplanar therewith, each of said disks being rotatable through a limited angle to bring one or the other of its slots over and in alignment with the coacting tumbler, the aperture of each disk being of substantially the same radius as said barrel between the slots and to a point substantially beyond one of said slots and having a substantially greater radius from said point to the other slot, and a tum-

bler in said other slot of each disk adapted to rest on its coacting tumbler and engage said barrel to prevent rotation thereof.

8. In a lock of the kind described, bolt
5 controlling mechanism comprising a plate adapted to be secured to the outer face of a door, a cylindrical casing secured to the inner face of said plate at right angles thereto, said plate being provided with a circular aperture coaxial with said casing, a barrel having its outer end rotatably mounted in said aperture and having an axial key way opening at said outer end and an axial slot communicating with said key way and opening
10 through the side of said barrel, a plurality of apertured disks strung on said barrel and having their outer peripheries fitting said casing, said casing being cut away at one side and each of said disks having a radial
15 lug adapted to contact the edges formed by cutting away said casing to limit rotation of said disks through a predetermined angle, each of said disks having two angularly spaced inwardly opening slots, the aperture
20 of each disk having substantially the radius of the barrel between said slots and to a point beyond one of said slots and having a substantially greater radius from said point to the other slot, a number of tumblers in said
25 axial slot corresponding to the number of said disks and each having an inclined outer end, a tumbler in said other slot of each disk having an inclined end adapted to fit the inclined end of its coacting tumbler, said disks
30 when rotated through said predetermined angle having one or the other of their slots over said axial slot.

9. In a lock of the kind described, bolt
40 controlling mechanism comprising a plate adapted to be secured to the outer face of a door, a cylindrical casing secured to the in-

ner face of said plate at right angles thereto, said plate having a circular aperture coaxial with said casing, a barrel having its outer end rotatably mounted in said aperture, and
45 having an axial key way opening at said outer end, a plurality of apertured disks strung on said barrel and having their outer peripheries fitting said casing, said casing being cut away at one side and each of said
50 disks having a radial lug adapted to contact the edges formed by cutting away said casing to limit rotation of said disks through a predetermined angle, each of said disks having two angularly spaced inwardly opening
55 slots, a number of tumblers mounted for radial movement in said barrel corresponding to the number of said disks and coplanar therewith, and a tumbler in one of the slots of each disk adapted when aligned with its
60 coacting plunger to engage said barrel and prevent rotation thereof.

10. In a lock, an elongated member having an axial slot consisting of a lower portion adapted to receive a key and a wider upper
65 portion opening through said member, a plurality of plates adjustably mounted in planes transverse to said member, each of said plates having two spaced slots adapted to register with said axial slot, a number of
70 tumblers loosely mounted in the wider upper portion of said axial slot corresponding to the number of said plates and coplanar therewith, each of said plates being adjustable to bring one or the other of its slots into
75 alignment with the coacting tumbler, and a tumbler in one of the slots of each plate adapted to rest on its coacting tumbler and to project slightly into said axial slot.

In testimony whereof I hereunto affix my
80 signature.

EDWARD R. VIVES.