

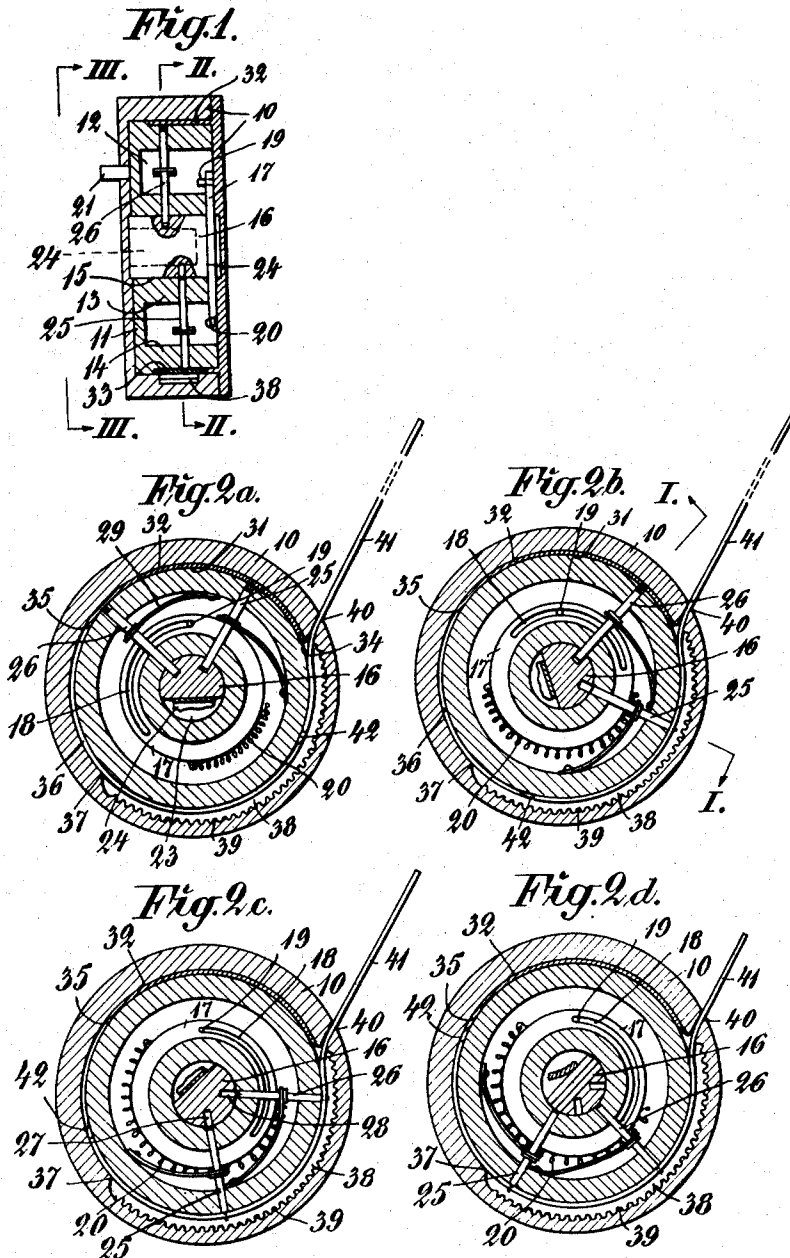
Oct. 27, 1953

F. NILSSON
LOCK MECHANISM

2,656,707

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2 Sheets-Sheet 1



INVENTOR
FABIAN NILSSON
BY
Toulmin & Toulmin
ATTORNEYS

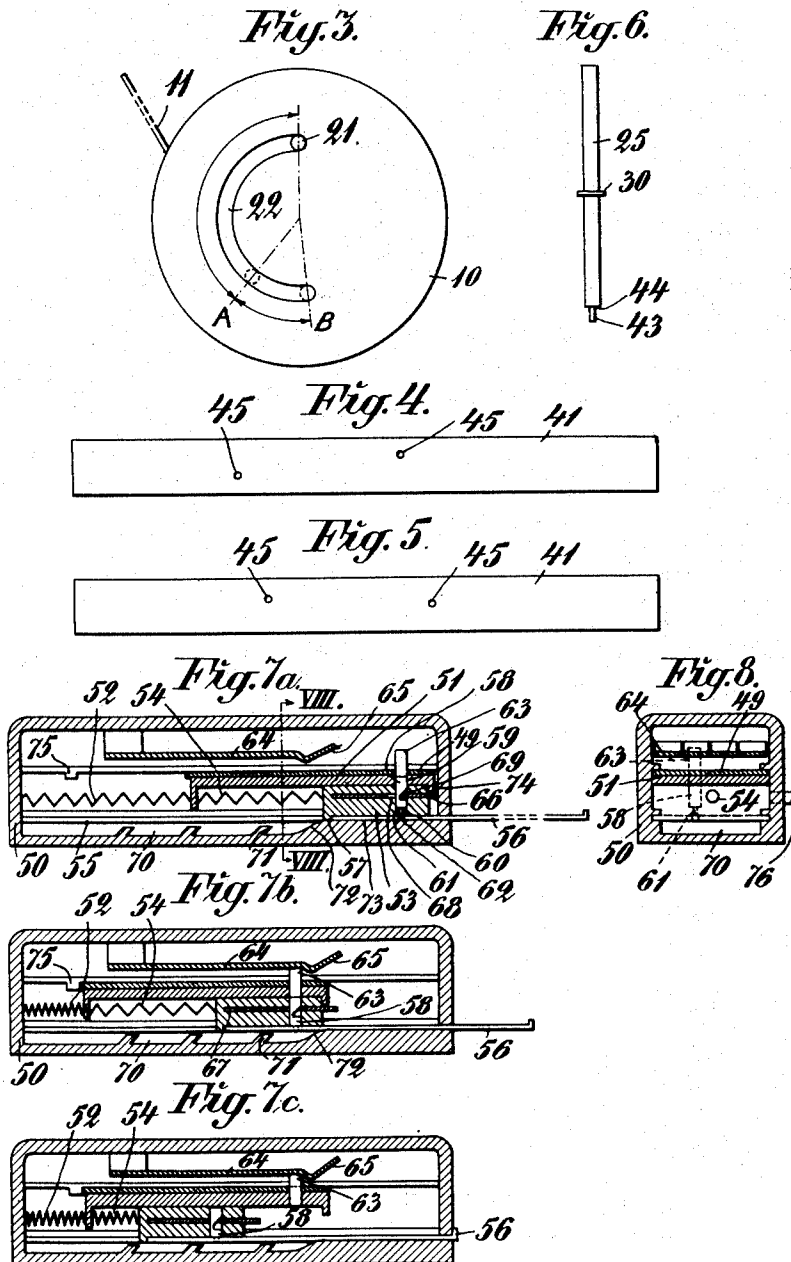
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LOCK MECHANISM

Fabian Nilsson, Stockholm, Sweden

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The present invention relates to such mechanisms, for instance lock mechanisms, which comprise a shiftable member, for instance a catch for the bolt of a lock, which can be shifted only by the aid of a key which suits the individual mechanism.

In hitherto known lock mechanisms and other mechanisms of the kind set forth the appertaining keys are comparatively heavy and take up a great deal of room, at least when burglar-proof mechanisms are concerned, so that only a limited number of keys can conveniently be carried in the same bunch of keys. This is an inconvenience which is particularly serious in such cases where one and the same person has to take care of a very great number of keys, for example newspaper distributors, which must have front door keys to all the houses where newspapers are to be delivered early in the morning, night watchmen, concierges, cashiers, et cetera.

The present invention has for its object to provide a mechanism of the kind set forth in which the said inconveniences are avoided by making the key for the mechanism in the shape of thin, in some cases flexible band of steel or other suitable material. The mechanism proper may comprise, in accordance with the invention, a number of individually grouped locking pins, which extend transversely to a guide for the band-shaped key and are adapted normally to lock the member, which is to be shifted or released by means of the key, and to enter, on the insertion of the correct key in the guide, into correspondingly grouped perforations in the key while releasing the said member. In such mechanism even a single one or a small number of locking pins may be placed or grouped in a very great number of different ways, both longitudinally and transversely of the key guide, so that the possible number of keys having mutually different positionings and/or combinations of perforations becomes very great.

In case a still greater number of variation possibilities is required than is obtainable by increasing the number of locking pins and the number of perforations of each key, such an increase is readily obtainable in accordance with the invention by making those ends of the locking pins which co-operate with the perforations of the key with different diameters and/or forms and shapes the perforations in the key in a corresponding manner. As a matter of fact, so many mutually different mechanisms and keys respectively may be made in accordance with the invention, that it is entirely out of the question that the shiftable member of the mechanism could be released or shifted respectively by any person other than the one who is in possession of the correct key, this being true even if the keys are

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made so small that several hundred keys may be conveniently carried in the same bunch of keys.

In a particularly suitable embodiment of the mechanism according to the invention the locking pins are adapted to enter the perforations of the correct key with reduced end portions only, the key guide being then provided, on the side opposite the locking pins, with one or more locking teeth which are engaged by the locking pins if a key having correctly placed or grouped, but too large, perforations is used, so that the shifting of the member in question or the continued insertion of the key into the key guide is prevented.

Particularly, when it is desired not only to release but also to shift a member in the mechanism by means of the key, for instance when it is desired to displace a catch for a lock bolt from its locking to its non-locking position, the mechanism according to the invention may suitably be made so that on the insertion of the key into the key guide the member is first released and is thereafter shifted by the key during the continued movement of the key along the guide. The locking pins may then be arranged so as to couple together normally the member, which is to be released and shifted by means of the key, with a member which is arranged for limited movement together with the first mentioned member on the insertion of the key into the key guide and consecutively to leave the engagement with the latter member, so that the member in question may be moved past the limit position of the member having a limited movement by inserting the key further into the key guide.

In the mechanism according to the invention the locking pins may be radially guided in a member, which is rotatable about a fixed axis, and the key guide may be designed to follow a circle which is concentric with the said axis, but also mechanisms having a straight or other non-circular key guide and locking pins extending transversely to such guides are conceivable.

Two embodiments of a mechanism according to the invention are illustrated by way of example on the attached drawings.

On such drawings:

Figure 1 is an axial section through the first embodiment.

Figures 2a-d are cross sections on the line II-II in Figure 1 and show the various movable parts in four different positions.

Figure 3 is an elevation showing the mechanism as viewed in the direction of the arrows III-III in Figure 1.

Figure 4 is a plan view of an appertaining key.

Figure 5 shows, for the sake of comparison, a plan view of a key which does not suit the mechanism.

Figure 6 is an enlarged side view of one of the locking pins.

Figures 7a-c are longitudinal sections through a second embodiment and show the movable parts in three different positions.

Figure 8 is a cross section along line VIII-VIII of Figure 7a.

Referring first to Figures 1 to 6 of the drawings, the embodiment of the mechanism according to the invention illustrated therein comprises a permanently closed housing 10 in the form of a cylindrical flat box. Turnably mounted in the housing or box 10 is a wheel 11 provided with an annular recess 12 in one of its side faces, so that a hub portion 13 and a rim portion 14 are formed, and with a cylindrical axial bore 15. Inserted in the axial bore 15 is a journal 16 provided with a flange 17 having a circular slot 18 into which engages a stop pin 19 on the housing, so that the journal 16 is turnable with respect to the housing 10 only between two definite limit positions. A tensional spring 20, which extends between a point on the housing 10 and a point on the flange 17, strives to turn the journal 16 counterclockwise in Figure 2a and normally holds the journal in the limit position in Figure 2a.

A pin 21, which is rigidly secured in the wheel 11, extends through a semi-circular slot 22 in the housing 10. Said pin is adapted, by means of a movement transmitting mechanism not shown, to be coupled with the catch for a lock bolt, for instance.

Disposed in a recess 23 in the journal 16 is a leaf spring 24, which is secured to the surrounding hub 13 and is adapted to press with its free end against the plane bottom of the recess so as to hold the wheel 11 and the journal 16 yieldingly in the relative angular positions shown in Figures 2a-c.

In addition, the wheel 11 and the journal 16 are normally positively coupled together by means of a number of, in the shown example two, radially extending locking pins 25 and 26 which are longitudinally displaceable in the wheel and are adapted to enter with their free ends corresponding bores 27 and 28 in the journal 16. Leaf springs 29, which at one of their ends are rigidly secured to the rim portion 14 of the wheel and are adapted to press with their other ends against a shoulder 30 on the respective locking pins, endeavour to move the locking pins out of engagement with the bores in the journal. The locking pins are, however, normally held inserted in the bores due to the fact that their outer ends abut against a guide surface 31 on the housing 10 formed by a flange 32 on the lid portion of the housing, said flange 32 projecting into a corresponding annular recess 33 in the outer cylindrical surface of the wheel rim 14.

The flange 32 is interrupted between the points 34 and 35, so that there is formed between the housing 10 and the wheel rim 14 a channel 36 of rectangular cross section, said channel serving as a key guide. Between the point 34 and a point 37 there is provided, right opposite the guide, a somewhat narrower circumferentially extending groove 38 in the cylindrical wall of the housing, and at the bottom of said groove there are provided locking teeth 39. At the point 34 there is provided in the wall of the housing a rectangular opening 40 which smoothly connects to the channel 36 and through which there may be inserted into said channel a key in the form of a flexible steel band 41 which fits accurately in the channel. Provided on the wheel 11 is an abutment 42, 75

which in the normal position of the wheel lies a short distance in front of the key opening 40 and against which the end of the key 41 is adapted to abut.

As will be clear from Figure 6, which shows a locking pin on an enlarged scale, the locking pins are provided at their outer ends with a reduced portion 43 of such a length that a shoulder 44 is formed on the pin at a distance from its outer end which somewhat exceeds the depth to which the pins with their inner ends enter the locking holes in the journal 16. The locking pins are adapted to enter with said reduced end portions 43 corresponding perforations 45 in the key 41 when the latter is inserted into the key guide 36 through the key opening 40, as will be clear from the following description of the manner of operation of the mechanism.

When the key 41 is inserted through the key opening 40 into the key guide 36 it engages with its end the abutment 42 on the wheel 11 and compels said wheel to turn clockwise with regard to Figure 2a while carrying along the journal 16 coupled therewith. The locking pins 25 and 26 then slide with their outer ends along the guide surface 31, while the band-shaped key is bent to conform to the circular key guide and to form with its inner surface a direct continuation of the fixed guide surface 31 on the housing 10. When the wheel 11 has been turned so far that the first locking pin 25 is about to slide off the guide surface 31, the first perforation 45 in the key 41 has been moved right opposite the locking pin, so that said pin, under the action of its spring 29, enters the perforation with its reduced end 43 and engages the inner side of the key band with its abutting surface 44. This movement is sufficient to permit the inner end of the locking pin entirely to leave the locking hole 27 in the journal 16, but it is not sufficiently large for the outer end of the locking pin to reach the locking teeth 39 on the housing 10. On continued insertion of the key 41 into the key guide 36, the rotation of the wheel 11 is thus continued, permitting the pin 26 to enter the second perforation in the key.

The positive coupling together of the wheel 11 and the journal 16 has now ceased, so that thereafter the journal 16 will follow the wheel only on account of the resilient coupling by means of the leaf spring 24. Soon after the last locking pin 26 has left the journal 16, the limit pin 19 secured in the housing will engage with the other end of the slot 18 in the flange on the journal, so that further turning of the journal 16 is rendered impossible. On further insertion of the key into the key guide, only the wheel 11 will thus turn. Said latter portion of the movement of the wheel 11, during which the pin 21 projecting through the wall of the housing moves between the positions A and B in Figure 3, constitutes the useful shifting movement and may be utilized for various practical purposes, for example to remove a catch for the bolt of a locking mechanism, not shown, for closing an electric contact in an operating circuit, et cetera.

In a mechanism of the kind set forth the perforations 45 in the key 41 must not only be placed in a correct mutual grouping and at a correct distance from the end of the key, but the perforations must also have the correct size and shape, i. e. they must be large enough to permit the reduced end portions 43 of the locking pins 25 and 26 to pass but they must not be so large that the movements of the locking pins are not

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stopped by the key band through engagement with the abutting surfaces 44 of the pins. In case one of the perforations in the key should be too large, the locking pin would move too far outwards and engage a locking tooth 39 on the housing, thus preventing a continued insertion of the key. If it is attempted to use a key having too small or wrongly grouped perforations, for example the key according to Figure 5, or a key which is entirely void of perforations, the locking pins cannot leave the locking holes in the journal 16, wherefore the latter remains rigidly coupled with the wheel 11, so that the journal, after it has reached its limit position, will prevent further turning of the wheel 11, i. e. it will prevent the wheel from performing the useful or active portion of its movement.

In a mechanism according to the invention the locking pins may in practice be made very thin, for example of the order of magnitude of .5 millimeter in diameter, and the key may be made correspondingly narrow and short. The selected thickness of the key should not be greater than is necessary to assure that the key is sufficiently rigid to be able to catch and retain the locking pins and to transmit a sufficient force for shifting the wheel 11 and the lock bolt catch or the like coupled therewith. If the key is made of band steel or other suitable material, a thickness of only .1 millimeter will in many cases be sufficient.

In the embodiment illustrated in Figs. 7a-c and 8 having a straight guide for the key there is provided in a housing 50 a slide 51 which is linearly displaceable against the action of a spring 52 from the normal position shown in Figure 7a to the limit position shown in Figure 7c. In the slide 51 the member 53, which is to be actuated by means of a key, is in turn linearly slideable against the action of a spring 54 from the normal position shown in Figures 7a and b to the limit position shown in Figure 7c. In the same plane with the underside of the key-operated member 53 there are provided in the opposite walls of the housing two grooves 55, which form a straight guide for a band-shaped key 56. For cooperation with the end of the key an abutment 57 is provided on the member 53.

The slide 51 and the key-operated member 53 are normally coupled together by means of a locking pin 58, which extends transversely to the key guide and is axially moveable in corresponding bores 59 and 60 in the slide and member respectively. The locking pin 58 is, similarly to the locking pins of the embodiment according to Figures 1 to 6, provided at its lower end with a reduced portion 61, so that an annular abutting surface 62 is formed near the lower end of the locking pin. Against the upper end of the locking pin abuts an auxiliary pin 63 which is axially moveable in the bore 59. For cooperation with the upper end of said auxiliary pin there is provided a leaf spring 64, which is rigidly secured at one end in the housing 50 and the free end of which is bent to form an inclined surface 65.

For shifting the locking pin 58 to the coupling position shown in Figure 7a and for holding the pin in said position there is provided a thin plate 66 which is moveable in a slot 67 in the key-operated member 53, said slot being parallel with the key guide. The plate 66, which at its rear edge permanently projects outside the slot 67, is provided with a circular hole 68 for the locking pin, and the latter is provided right opposite the said hole with a notch having an inclined sliding

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surface 69 adapted for cooperation with the edge of the hole.

In the bottom of the housing wall right opposite the path of movement of the locking pin there is arranged an elongated recess 70 provided with a plurality of locking teeth 71. The bottom of the recess merges via an inclined sliding surface 72 with a surface 73 which coincides with the underside of the key.

The mechanism shown in Figures 7a-c and 8 operates in the following manner.

On insertion of the key 56 through the key-hole the key engages with its inner end the abutment 57 and pushes the parts 51 and 53 which are coupled together by means of the locking pin 58 to the left while compressing the spring 52. The auxiliary pin 63 then enters into engagement with the inclined surface 65 on the leaf spring 64, the auxiliary pin 63 and thus also the locking pin 58 being then pressed down through the holes 59 and 60. If a correct key has been inserted in the key-hole, a perforation in the key will then be positioned right opposite the reduced end 61 of the locking pin, so that the locking pin can enter the perforation with said end and place itself with its annular abutment surface 62 against the upper side of the key band 56, as is clearly seen in Figure 7b. The contact surface between the locking pin 58 and the auxiliary pin 63 is now positioned in the same plane as the sliding surface between the slide 51 and the key-operated member 53, so that the positive coupling together between said parts has ceased. Under the action of the spring 54, which is more powerful than the spring 52, the member 53 will remain in its normal position relatively to the slide 51, however, pressed against an abutment 74 on the slide, and carry along the slide during its movement until the slide with the front edge of the thin plate 49, with which it is coupled together by means of the auxiliary pin 63, abuts against a fixed abutment 75 on the housing 50. On further insertion of the key the member 53 is displaced along the slide 51 while compressing the spring 54, as seen in Figure 7c, the auxiliary pin 63 being then, on account of clamping action between the plate 49 and the pin, retained in the position shown in the said figure. The latter movement of the member 53, which constitutes the useful movement, may be transmitted by means of the pin 76, which projects through the housing wall, to e. g. the catch for the bolt of a lock mechanism, not shown.

When the locking pin 58 was moved downwards through the bore in the member 53 the plate 66 was, due to cooperation between the inclined surface 69 on the pin and the edge of the hole 68 in the plate 66, forced to move further out of the slot 67 to the position shown in Figures 7b and 7c.

When thereafter the key 56 is retracted from the key guide, the member 53 first returns to its normal position with respect to the slide 51 under the action of the spring 54. Thereupon the slide 51 and the member 53 are displaced further as a single body under the action of the spring 52. Near the end of said movement the plate 66 abuts on the housing 50, the edge of the hole 68 is pressed against the inclined surface 69 on the locking pin 58 and the latter is forced upwards and into the bore 59 in the slide 51, the lower end of the locking pin being then simultaneously pulled out of the perforation in the key. The parts have now returned to their normal positions according to Figure 7a and the key may be taken entirely out of the mechanism.

If somebody should try to use a key having an incorrectly positioned perforation, the locking pin 58 can evidently never be moved down out of the bore 59 in the slide 51 and consequently the coupling between the slide 51 and the key-operated member 53 cannot be released which, according to the above, is necessary if the slide shall be able to perform the last and useful part of its movement.

If instead an attempt is made to use a key having too large a perforation, consisting e. g. of a correctly placed circular hole having at least the same diameter as the main portion of the locking pin 58, the locking pin will not be arrested by the key but will be pressed so far down under the action of the spring 64 that its lower end enters into engagement with the first locking tooth 71 at the bottom of the housing 50. Further displacement of the member 53 is hereby prevented, so that said member cannot even start its useful movement.

Although the invention has been described above as applied to mechanisms having a key-operated member in the shape of a turnably mounted wheel and a circular guide for a flexible key, and in a mechanism having a rectilinearly displaceable key-operated member and a straight key guide, it is, of course, not limited to said embodiments but the inventive idea may be realized also in other ways than those shown on the drawings and described in detail above.

I claim:

1. A lock mechanism comprising in combination, a housing, a guideway in said housing for a band-shaped key having a perforation therein, a first member guided for movement in said housing, a second member guided for movement in said housing and with respect to said first member, locking pin means extending transversely of said key guideway and reciprocable in bore means in said first and second members, said locking pin means being normally positioned to couple together said first and second members for unitary movement, an abutment extending from said second member into said key guideway for engagement by said key when slidably inserted therein, means for limiting the movement of said first member with respect to said housing, spring biased means for axially displacing said locking pin means into the perforation of said key during movement of said first member from its initial position to its limit position, said locking pin means being arrested in its movement into said perforation when it reaches a position to release said second member from said first member for permitting said second member to move relative to said first member and with respect to said housing upon further insertion of said key, means for restoring said second member to its initial position with respect to said first member upon a predetermined withdrawal of said key, means for preventing the movement in one direction of said second member relative to said first member from said initial position, and means operable upon a further and predetermined withdrawal of said key to cause said locking pin means to move back to said normal locking position.

2. A lock mechanism comprising in combination, a housing, a guideway in said housing for a band-shaped key having a perforation therein, a first member guided for movement in said housing, a second member guided for movement in said housing and with respect to said first member, locking pin means extending trans-

versely to said key guideway and reciprocable in bore means in said first and second members, said locking pin means being normally positioned to couple together said first and second members for joint movement, an abutment extending from said second member into said key guideway for engagement by the key when slidably inserted therein, means for limiting the movement of said first member with respect to said housing, means for axially displacing said locking pin means into the perforation of said key during movement of said first member from its initial position to its limit position, said locking pin means being arrested in its movement into said perforation when it reaches a position to release said second member from said first member for permitting said second member to move with respect to said first member and with respect to said housing upon further insertion of said key, means for restoring said second member to its initial position with respect to said first member upon a predetermined withdrawal of the key, means for preventing movement in one direction of said second member relative to said first member from said initial position, and means for restoring said locking pin means to its normal locking position upon withdrawal of said key from said lock mechanism.

3. A lock mechanism comprising in combination, a housing, guideway means in said housing for guiding a key having perforation means, a first member guided for movement in said housing, a second member guided for movement in said housing with respect to said first member and parallel with said key guideway means, locking pin means extending transversely to said key guideway and reciprocable in bore means in said first and second members, said locking pin means being arranged normally to couple together said first and said second members for joint movement, abutment means associated with said second member and extending into the guideway for engagement by said key when the latter is being inserted into said housing and along said guideway, means for limiting the movement of said first member with respect to said housing, means operable in response to the movement of said first member into its arrested position and against said means for limiting the movement thereof with respect to said housing for bringing about movement of said locking pin means axially for releasing the interlocking engagement of said pin with said members permitting said second member to move relative to said first member and with respect to said housing, means for restoring said second member to its initial position with respect to said first member upon a predetermined withdrawal of said key, means for preventing the movement in one direction of said second member relative to said first member from said initial position, and means operable upon a further and predetermined withdrawal of said key to cause said locking pin means to move back to said normal locking position.

FABIAN NILSSON.

References Cited in the file of this patent

Number	Name	Date
271,962	White	Feb. 6, 1883
823,222	Jorgenson	June 12, 1906
1,163,470	Schoell	Dec. 7, 1915
1,476,841	Raymond	Dec. 11, 1923