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(54) **Multi-lever lock, manufacturing method and lever of multi-lever lock**

(57) A method of manufacturing of multi-lever lock is characterized by this, that all particular components of lock are prepared and piled pack of identical levers (6) is bended on a key until front parts (6e) reach a position proper to location of socket (3b) of bolt. Multi-lever lock, inside of body (1) under cover (2) contains a pack of levers (6) fixed on common fixing pin (1c). Lock has

moving out bolt (3) fixed permanently to base plate (3a) located under levers (6) pack. Inside of lock, in axis of shaft (7a) of key (7) are executing elements in mean of pressure (4) and turning plate (5). Lever (6) has front part (6e) connected by bending zone (6d) with central part. In this central part each lever (6) has a fixing orifice (6b) fixed on common fixing pin (1c) fastened to lock body (1) bottom.

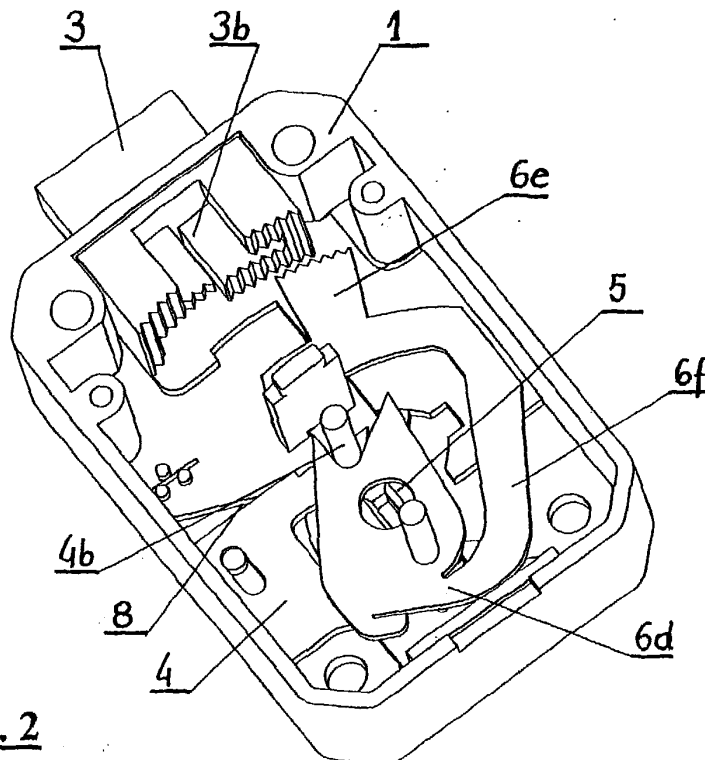


Fig. 2

Description

[0001] The subject of invention is method of manufacturing a multi-lever lock, multi-lever lock as well as a lever of multi-lever lock. Lock is operated by key and is destined especially for the doors of safes and of armoured cupboards, cupboards and treasury doors and other devices being locked. May also be used as supervisory door lock.

[0002] Multi-lever locks manufactured in known way characterizes by this, that all components are fabricated prior to assembling process. Housing is casted, a bolt is casted or cut and machined, other parts are formed from steel plates and rods. During forming operations of remaining details from steel plates & rods, also levers are formed and then piled into a pack inside housing of a lock. Each lever, must have it's individual shape in section cooperating with key and bolt, where working section of key will cooperate with proper cut-outs of particular levers. In known solutions, a serie of different levers for each lock are produced, individual placing of these levers, different in particular locks is performed. This fact creates the necessity to produce levers different in shape, what complicates lock production process. In known system levers are being cut by punch. In that way from 6 to 12, or more levers are being cut for each individual lock. In some other known solutions, in a pack of equal levers placed on earlier pre-cut key, common working lever surface is being machined, in position which each individual lever adopts in "open" position of a key. This way a cut-out in working surface of lever pack is performed, to enable absorption of a rear part of a bolt into levers pack.

[0003] In the solution known from the description of the Polish patent application nr P 345978, multi-lever lock inside of housing contains a pack of levers mounted on common fixing pin. Lock has sliding bolt fixed to a base plate placed under levers pack. Inside of lock is executing part formed by a turning element. Each of levers has wide front part connected by a neck with rear part. In neck of each lever is key hole and in front part each lever has a transverse guiding orifice placed on guiding pin common for all levers. In this known solution each lever has on one side two straight pieces of spring wire, one fastened to front part and other to rear part of a lever.

[0004] There are several known constructions of levers for locks. Known lever is a plate, having an orifice for mounting it on pin common for all levers. Each lever usually has a spring and cut-out having edges cooperating with working section of a key. These edges are formed differently in each lever and have different curvature radius, to enable slip of key. In these known solutions lever has front protrusion to be absorbed by bolt socket. Pack of such levers is piled inside of lock housing and cooperating with pre-cut grooves of key enables or blocks movement of bolt. Known description of lever has been described in the notification of the innovation

nr P 345978. Lever acc. to this known solution has wide front part connected by neck with rear part. In rear part a lever has fixing orifice, and in neck is a hole for key. In front part lever has a transverse guiding orifice. On one side of lever, there are two straight pieces of spring wire as springs. One of springs is fastened to front part, the other in this known solution is fastened to rear part of lever.

[0005] The purpose of this innovation is to create a new way of multi-lever lock production and new construction of lock, as well as as new construction of a lever of multi-lever lock. The solution presented in this innovation aims to increase the combination number of the lock, to relieve lock springs at stand-by position, and to reduce the production costs of the lock.

[0006] In manufacturing process of multi-lever lock, all particular components of lock are being prepared for assembling. Then working surface of lever pack fixed on working section of key is made, in compliance to shape of rear part of bolt, and then the pack of levers prepared in the described way is placed inside of the lock housing, together with remaining lock mechanism components. In accordance with this innovation, method of production of multi-lever lock is characterized by this, that working surface of levers pack is formed in the way, that this lever pack is placed on assembling stand in accordance with the coded cuts of key. Then, front part of levers cooperating with bolt are bended until front parts will reach a position adequate to bolt socket location, with which these levers are working. In a specific one advantageous solution, levers are bended successfully each after other. The other solution characterizes by this, that levers are bended in several operations, few levers in each.

[0007] Inside of it's housing a multi-lever lock has, under the cover, pack of levers fixed on common fixing pin, and has sliding bolt fix permanently to base plate of bolt under pack of levers. Inside of lock, in axis to key's shaft is an executing element in mean of a turning plate. Bolt contains a socket having shape proper to shape of front parts of levers piled into pack on key in open lock position. In accordance with the innovation, multi-lever lock is characterized by this, that has a pressure in form of plain plate placed under levers pack and equipped with vertical resisting part and vertical pin, fixing placing of levers. A pressure cooperates by it's edge with pressure spring fixed in lock body. Turning element is a plain plate placed in cut-out of pressure. Turning plate is equipped with a driver cooperating with cut-out in plate of bolt base. From underneath, turning plate has round fixing pivot rotary placed in orifice in bottom of lock housing. Bolt socket is divided for at least two displaced segments. A base of bolt has at least one side edge cooperating with internal surface of lock housing. Key is made of the round shaft with circular grooves cut on its working section. System of these grooves creates a key code. End of key is ended by working section, cooperating with an orifice in turning plate. This working end of

key shaft is plain, while orifice in turning plate has shape of an aperture, not smaller in section than transverse section of this working plain end of key shaft. This does not exclude possibilities of using different types of key in a lock, in accordance with the innovation.

[0008] Lever of multi-lever lock in a form of plain plate, has a spring and one fixing orifice with diameter proper to diameter of guiding pin mounted in lock housing. Lever has front part cooperating with socket in rear part of bolt, and width of front part of lever is proper to width of a socket in rear part of bolt. In middle part lever has at least one edge cooperating with working section of a key. In accordance with the innovation, multi-lever lock lever is characterized by this, that plain plate of a lever has at least one bending zone smaller in section than sections of remaining fragments of plate of lever, and this bending zone is adapted for bending operation of lever in plane being harmonic to plane of lever. Edge of lever, cooperating with working section of a key, may have a shape of orifice. This does not exclude use of other shapes of this lever edge. Lever has basic part with fixing orifice and an edge cooperating with key and this basic part is connected with arm alongside of this basic part, where front part of lever is mounted to this arm, while bending zone is located by root of arm.

[0009] In other solution, according to the innovation, lever is a plate with internal cut-out cooperating with working section of key and having narrow side walls. In that solution two bending zones are situated between middle part, cooperating with working section of key and front part of lever, cooperating with socket of a bolt, where between fixing orifice and a front part of lever is at least one zone compensating loss of length of lever. Such compensation zone allows to compensate loss of lever length in cases where bending operation may cause such losses.

[0010] In following solution, according to innovation, lever has an arch shape, where on one end of arch is front part of lever, on the other end is fixing orifice and near to one of these ends of this arch is an arm which edge cooperates with working section of key. Bending zone of a lever of this kind is near to fixing place of this arm on arch of a lever.

[0011] In another solution, in accordance to this innovation, lever is a plate with internal cut-out, where on one end of this plate is a fixing orifice, and on the other is front plate of lever, whereas in internal cut-out is an arm cooperating with working section of key. In this solution of lever, bending zone is in place of fixing of this arm in internal cut-out.

[0012] In the following solution according to the invention, lever has the main part with fixing orifice and cut-out cooperating with working section of key, while front part of lever is mounted to main part, on at least one arm, wherein on this arm is at least one bending zone. The subject of the innovation is described below in examples of execution. Described is example method of production of a multi-lever lock and an example of multi-

lever lock execution, as well as examples of multi-lever lock execution. The enclosed drawings show:

- Fig. 1- a picture of particular lock components,
- 5 Fig. 2- a picture of a lock with cover taken out and with one lever,
- Fig. 3- a picture of levers pack, seen from the front, before bending operation,
- Fig. 4- a picture of lever pack, seen from the front, after bending operation,
- 10 Fig. 5- a picture of a lock mechanism, seen from the top, without levers pack, in position "locked"
- Fig. 6- a picture of lock mechanism acc. to Fig. 5 during work of turning plate and pressure,
- 15 Fig. 7- a picture of lock mechanism acc. to the Fig. 5, in position "opened"
- Fig. 8- a picture of the second version of lever,
- Fig. 9- a picture of the third version of lever,
- Fig. 10- a picture of the fourth version of lever,
- 20 Fig. 11- a picture of the fifth version of lever,
- Fig. 12- a picture of the sixth version of lever,
- Fig. 13- a picture of the seventh version of lever,
- Fig. 14- a picture of the eighth version of lever,
- Fig. 15- a picture of the ninth version of lever,

[0013] Manufacturing method of multi-lever lock is characterized by this, that particular components of lock are being prepared for assembling. The main components of the lock, as shown on the enclosed drawing Fig. 1 are body 1, cover 2, bolt 3, pressure 4, turning plate 5, levers 6 and a key 7. On the drawing Fig. 1, for it's clarity is shown one lever 6, but in multi-lever lock usually are several, or anyhow from ten to twenty of levers 6. In example execution shown on the enclosed drawing fig. 1, fig. 2, fig. 3 and fig. 4, lock contains ten
 30 of levers 6. On the drawing fig. 1, there are shown two levers, while on the drawing fig. 2, for it's clarity there is shown one lever. Levers are being fixed at assembling stand in accordance with the code cuts of key 7, and then on this assembling stand bending is executed on front part 6e of levers 6 cooperating with bolt 3, to reach the position of this front part 6e of lever pack, being in compliance with shape and position of socket 3b of bolt 3 with which these levers 6 cooperate. According to one
 35 example of lever execution, levers 6 are bended successfully each after other. In other example of execution, levers 6 are bended in several operations, few levers 6 in each operation. Bending can include for example two levers in one operation, three levers in one operation or
 40 in another example of execution can include different number of levers in each operation. This depends on workshop organization solution, but also on shape of socket 3b at rear part of bolt 3. On the enclosed drawings, there is presented a pack of levers before bending operation-fig. 3, and after bending operation - fig. 4. On the enclosed drawings there are presented front parts 6e of levers. On the drawing fig. 3, levers 6 completed
 45 into pack, have front parts 6e displaced in disorder one

to other. This is result of fixing of identical levers on the common fixing pin 1c and on working section 7b of key 7 with differently formed protection code. Front part 6e of each lever 6 must find its place inside socket 3b of bolt 3, therefore each lever in accordance to invention must be bended and for this purpose is bending zone 6d in each lever 6. After bending operation, lever pack 6 takes arranged form, what is shown on the enclosed drawing fig.4. Front parts 6e of ten lever pack took the shape proper to socket 3b shape at rear part of bolt 3, with which they cooperate Bending operation was done on assembling stand in three stages, bending four levers first, then two levers and then four levers. It is because this example lock is equipped with ten levers. This does not exclude to use other number of levers 6 in the lock.

[0014] Multi-lever lock, as shown on enclosed drawing fig.1 and fig.2, has inside the housing 1, under cover 2 levers pack 6 fixed on the common fixing pin 1c. Lock contains sliding bolt 3 permanently fixed to plate 3a of bolt base, placed under pack of levers 6. For the clarity of the drawing on fig.1 there are shown two levers, while on fig.2 one lever is shown. Inside lock, in axis of shaft 7a of key 7, is located an executing element in a form of a turning plate 5. Bolt 3, from middle of lock, contains socket 3b having shape corresponding to shape of front parts of levers formed into pack on a key, in open position of lock. Under a pack of levers 6 in axis of bolt 3, there is pressure 4. Pressure is a plain plate, placed under a pack of levers 6 and consisting of vertical resisting part 4a and vertical pin 4b fixing positioning of levers. Pressure 4 has a side edge cooperating with pressure spring 8 placed in body 1 of lock. Turning plate 5 is formed as plain plate fixed at bottom of a lock body 1. Turning plate 5 is fixed in cut-out of pressure 4 and contain a driver 5a cooperating with cut-out 3c on plate 3a of bolt base 3. Turning plate 5 from underneath has a round fixing pin 5c. This pin 5c is fixed in orifice 1b in bottom of body 1 of a lock. On the drawings fig. 1 and fig. 2 there is shown bolt 3 seen from middle of lock. Here is socket 3b of a bolt. As shown, bolt socket has irregular shape. Socket 3b, having regular rectangular shape is divided into three, displaced towards each other segments 3e. Shape of this socket 3b imitated by placement of front parts 6e of levers 6, what is shown on the enclosed drawing fig. 4, where this regular rectangular shape is divided into three segments 3e, displaced towards each other horizontally. Division of socket 3b for the segments 3e shown on the fig.4 is an example, and in other examples of execution can happen other division of this socket. In example shown on fig.4, upper and lower segment of socket 3b correspond to four upper and four lower levers 6. Middle segment corresponds to two middle levers 6 at levers pack shown on the drawing fig. 4. Configuration of socket 3b creates difficulties for an unauthorized person to compose levers 6 from outside in the way enabling pulling in bolt 3 into lock, and to open lock without use of key.

[0015] On the drawing fig. 5 there is shown interior of lock in position "locked" and for the clarity of the drawing pack of levers shown on drawing fig. 4 is not shown. On the drawing fig. 5 is shown placing of bolt 3 with its socket 3b and plate 3a of bolt. Turning plate 5 has a driver 5a placed in cut-out of plate 3a of bolt 3. Second part of turning plate 5 is placed in cut-out of pressure 4. On the drawing fig. 6 the same lock is shown during the work. Rotation of turning plate 5 causes sliding of pressure 4 towards middle of body 1 of a lock and taking by a lever 6 position to cooperate with bolt socket 3b, what is shown on the drawing fig.2. In later stage the movement of turning plate 5 causes inserting of a bolt 3 towards middle of body 1, with simultaneous taking up by front parts 6e of levers 6 place inside socket 3b of bolt 3, what can also be seen on the drawing fig. 2. Lock mechanism in position "opened" is shown on enclosed drawing fig. 7. Bolt 3 is pushed into middle of body 1, front parts of levers, which are not shown on this drawing take the place inside socket 3b of bolt 3. The movement of turning plate 5 is controlled by key 7, not shown on this drawing.

[0016] A lever 6 pack is shown on the enclosed drawing fig. 4 after bending operation. Front parts 6e of levers, in position "opened" of lock, take shape corresponding to shape of socket 3b of bolt 3 shown on the drawings fig. 1 and fig. 2.

[0017] In the described example execution lock has a key 7 made of round rod 7a. On the working section of this bar 7a are cut circumferential grooves 7b. Configuration of these grooves creates a key code. Round shaft 7a of a key 7 is ended with working end 7c cooperating with orifice 5b in turning plate 5. This working end 7c of round shaft 7a of key 7 is plain, while the orifice 5b in turning plate 5 has the shape of slot being in section not smaller than cross-section of this working plain end 7c of round bar 7b of key 7. Orifice 5b being a slot is well seen in the orifice of a lever on the drawing fig. 2. This does not exclude the possibility to use in the lock according to innovation other type of key, besides described here driver-less key.

[0018] As shown on the enclosed drawing fig. 1 and fig. 2, lever 6 of multi-lever lock is in the form of plain metal plate and contains a spring 6a and one fixing orifice 6b having diameter proper to diameter of pin 1c set in the body 1 of lock. A lever 6 contains front part 6e cooperating with socket 3b in rear part of bolt 3. Width of this front part 6e of lever 6 is adopted to the width of socket 3b at rear part of bolt 3. In middle part lever 6 has at least one edge 6c cooperating with working section 7b of key 7. Plain plate of a lever 6 has one bending zone 6d having section smaller than section of remaining fragments of lever plate 6, while this bending zone 6d is adapted for bending operation of a lever in plane being in accordance with her own plane. In this example execution shown on the enclosed drawing fig. 1 and fig. 2, edge 6c of a lever, cooperating with the working section 7b of a key 7, has an orifice shape. In this example

of execution described above, lever 6 contain the basic part with fixing orifice 6b and an edge 6c cooperating with key 7. Edge 6c in this example of execution has orifice shape. The basic part of lever 6 is connected with an arm 6f located alongside this basic part of lever. Front part 6e of lever is fixed to arm 6f, while bending zone 6d is located at the root of arm 6f near to fixing orifice 6b.

[0019] In further examples of execution of lever in accordance to the innovation, presented are shapes of levers, not including a spring 6a, which in every case is a detail similar to a spring shown on the drawings fig. 1 and fig. 2. Another example of spring execution 6a is solely shown on the drawing fig. 14.

[0020] In second example of lever execution 6 shown on the enclosed drawing fig. 8, other type of lever according to the innovation is shown, adapted to work with twin-driver key. In this solution a lever 6 contains orifice 6b for fixing pin 1c, and in the middle part has a cut-out 6c for working section 7b of key 7. A lever in this execution has bending zones 6d located in side walls 6g, 6h. Connection of one of side walls 6h with a front part 6e of lever is broken.

[0021] In third example of execution shown on the enclosed drawing fig. 9, a lever is formed to work with twin-driver key, and is a plate with inner cut-out 6c cooperating with working section 7b of key 7 and with narrow side walls 6g,6h, where two bending zones 6d are located between middle part, cooperating with working section of key, and front part 6e of a lever cooperating with socket 3b of bolt 3. Between fixing orifice 6b and front part 6e of lever 6, are two concave zones 6i,6j compensating a length loss of lever 6. Total length of a lever 6 is decreased in connection with bending operation. As result of bending operation total length of lever 6 is shortening. In lever construction 6 in this example of execution, two additional concave zones are provided 6i,6j, giving possibility to compensate of this loss of total length of a lever 6.

[0022] In fourth example of execution shown, on the enclosed drawing fig. 10, a lever cooperating with twin-driver key is a plate with internal cut-out 6c in a middle part, cooperating with working section 7b of key 7 and with side walls 6g,6h where four bending zones 6d are located between middle part, cooperating with working section of a key, and front part 6e of a lever cooperating with socket 3b of bolt 3. Between fixing orifice 6b of front part 6e are two camber zones 6i,6j for lever length loss compensation, what fact is mentioned in the description of an example shown on the drawing fig. 6. In lever 6 construction, in this example of execution, two additional camber zones were provided 6i,6j, where in further bending operation exist a possibility to compensate lever total length loss.

[0023] In accordance with the fifth example of solution shown on the drawing fig. 11, a lever for twin-driver key contains middle part with fixing orifice 6b and cut-out 6c cooperating with working section 7b of a key 7. Front part 6e of a lever in it's main part is mounted on an arm

6o, and on this arm 6o is bending zone 6d.

[0024] In accordance with the sixth execution of example shown on the enclosed fig. 12, a lever cooperating with cylindrical driver-less key has an arch shape, where on one end of an arch 6k is front part 6e of lever. On the other end of arch 6k is fixing orifice 6b. Near to one of arch ends 6k, in it's middle, is an arm 6l, edge 6m of which cooperates with working section 7b of a key 7. This edge 6m in this example is of orifice shape. A bending zone 6d is near to this arm fixing place 6l, on arch 6k of a lever 6.

[0025] Other version of lever from fig. 12 is shown on the drawing fig. 13. In this seventh lever example of solution, edge 6m of an additional arm 6l of lever arch, cooperating with working section 7b of a key 7 has shape of a curve line.

[0026] A lever for cylindrical driver-less key, in eighth example of execution shown on the enclosed drawing fig. 14, is a plate with internal dual cut-out 6n, where in one end of this plate is fixing orifice 6h, and in the second end is front part 6e of a lever. In this example of execution lever contains a spring 6a created of it's own material. In internal dual cut-out 6n of lever 6 is an arm 6l cooperating with working section 7b of key 7. This arm 6l divides a cut-out 6n for two zones. Edge 6m of arm 6l cooperates with working section 7b of a key. Bending zone 6d is at place of fixing of this arm 6l in this internal dual cut-out 6n of a lever.

[0027] In accordance with ninth example of solution shown on the enclosed drawing fig. 15 a lever for twin-driver key contains a main part with fixing orifice 6b together with cut-out 6c cooperating with working section 7b of a key 7. A front part 6e of a lever is fixed to main part on an arm 6o of front part, and on this arm 6o are two bending zones 6d.

List of symbols used on a drawing.

[0028]

- 1 - Body.
- 1a- Housing wall.
- 1b- Fixing pin.
- 1c- Orifice in bottom of a body.
- 2- Cover of a body.
- 3- Bolt
- 3a- Plate of bolt's base.
- 3b- Bolt socket.
- 3c- Cut-out in plate of bolt's base.
- 3d- An edge of plate of bolt's base.
- 4- Pressure.
- 4a- A vertical resisting part of a pressure.
- 4b- A pin fixing positions of levers.
- 4c- Cut-out at pressure plate.
- 5- Turning plate.
- 5a- Driver of a turning plate.
- 5b- Orifice in the turning plate.
- 6- Lever.

- 6a- Lever spring.
- 6b- Mounting orifice.
- 6c- Edge cooperating with working section of a key.
- 6d- Bending zone.
- 6e- Front part of lever.
- 6f- An arm of front part of a lever.
- 6g- Side wall of lever.
- 6h- Side wall of lever.
- 6i- Concave compensation zone.
- 6j- Concave compensation zone.
- 6k- An arch of a lever.
- 6l- An arm of lever's arch.
- 6m- Edge of additional arm of lever arch.
- 6n- Internal dual cut-out
- 6o- Arm of front part of a lever.
- 7- Key.
- 7a- Key's shaft.
- 7b- Working section of key.
- 7c- Working end of a key.
- 8- A spring.
- 9- Connection screw.

Claims

1. Manufacturing method of multi-lever lock is **characterized by** this, that all lock components are prepared for assembling, working surface of levers pack is shaped while set on working section of key, in compliance to the shape of a socket of rear part of bolt, and then a pack of levers prepared in such way is placed inside a lock body together with remaining components of lock mechanism, wherein that working surface of levers pack (6) is formed in that way, that this levers pack (6) is fixed on assembling stand in accordance with code cuts of a key (7), and then front part (6e) of each lever cooperating with bolt (3) in plane of these levers is bended, until position of this front part (6e) is reached, in accordance with location of socket (3b) of bolt with which these levers cooperate.
2. Multi-lever lock, containing inside of it's body, under a cover a pack of levers fixed on a common fixing pin, and containing bolt slipped out from body, fixed fast to plate of bolt base, located under levers pack, while inside lock, in axis of key shaft is an executing element in mean of turning plate, and bolt contain a socket having shape corresponding to shape of front parts of levers stapled into a pack on a key in open position of a lock, wherein that lock contains a pressure (4) created by plain plate fixed under lever pack (6) and equipped with vertical resisting part (4a) and vertical pin (4b) assignating location of levers, where pressure 4 contains an edge cooperating with pressure spring (8) fixed in lock (1) body.
3. The lock according to claim 2, wherein that turning

plate (5) is a plain plate fixed in a cut-out of pressure (4), while a plate of a turning plate is equipped with driver (5a) cooperating with cut-out (3c) at plate (3a) of bolt base (3).

- 5 4. The lock according to claim 2, wherein that socket (3b) of bolt (3) is divided for at least two displaced each to other segments (3e).
- 10 5. The lock according to claim 2, wherein that base (3a) of a bolt (3) has at least one side edge cooperating with internal surface of side wall (1a) of body (1) of the lock.
- 15 6. The lock according to claim 2 or 3, wherein that shaft (7a) of a key (7) is ended by plain working end (7c) cooperating with orifice of an aperture (5b) in turning plate (5).
- 20 7. A lever of multi-lever lock in form of a plain plate, containing a spring and one fixing orifice having diameter suitable to a diameter of a guiding pin settled in lock body and containing a front part cooperating with bolt socket, whereas at middle part a lever has at least one edge cooperating with working section of key, wherein that plain plate of lever (6) has at least one bending zone (6d) with a diameter smaller than diameter of remaining fragments of lever plate.
- 25 8. The lever according to claim 7, wherein that edge (6c) of a lever (6), cooperating with a working section (7b) of key (7) has a shape of an orifice.
- 30 9. The lever according to claim 7, wherein that is a plate with internal cut-out (6c) to cooperate with working section (7b) of key together with narrow side walls (6g,6h), where bending zones (6d) are placed between middle part cooperating with a working section (7b) of a key and front part (6e) of lever, cooperating with socket (3b) of bolt (3), where between fixing orifice (6b) and front part (6e) of lever is at least one compensation zone (6i) of lever is at least one compensation zone (6i) of lever (6) length loss.
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- 50
- 55

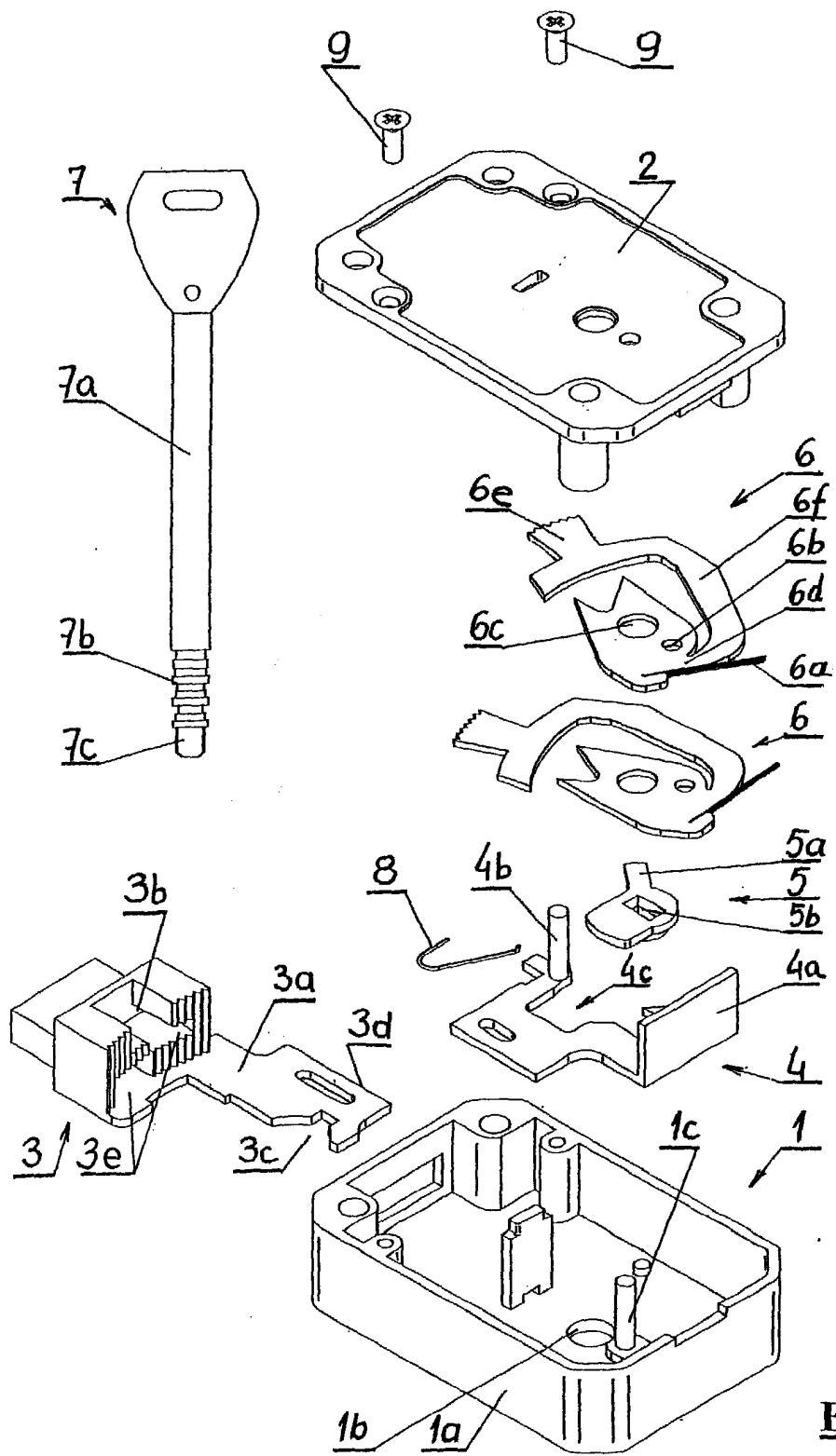


Fig. 1

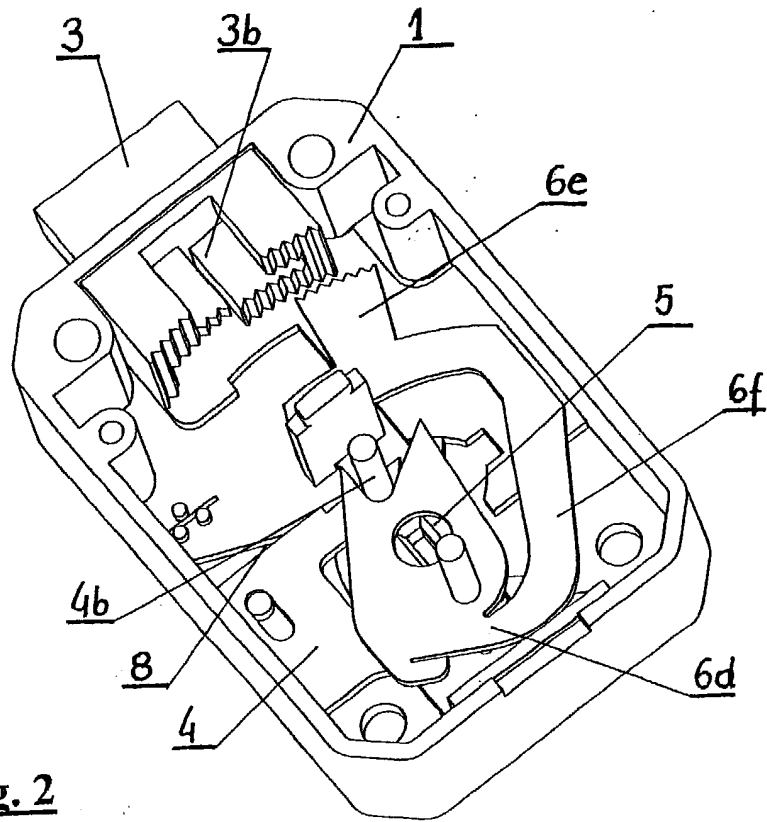


Fig. 2

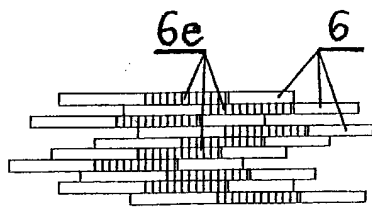


Fig. 3

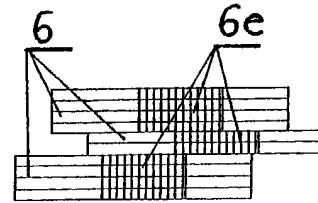


Fig. 4

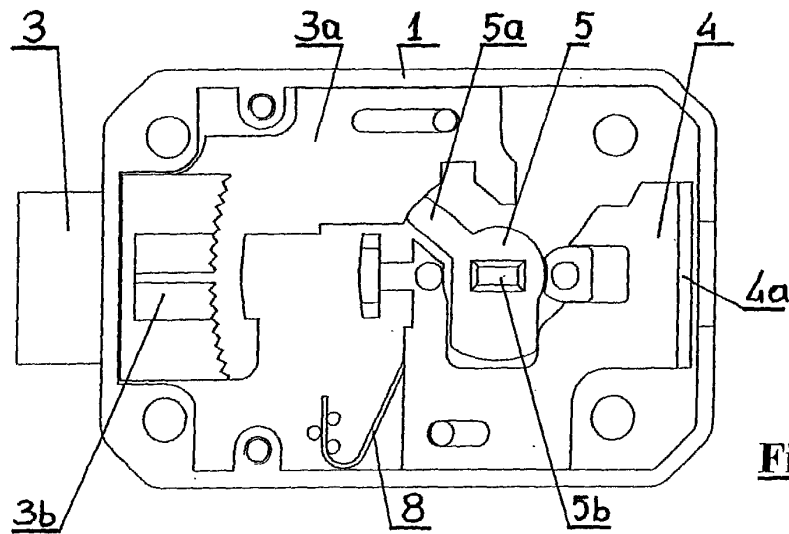


Fig. 5

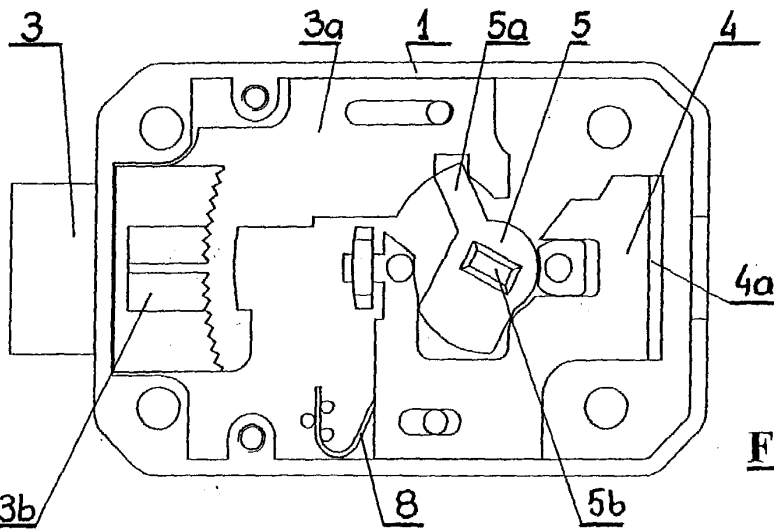


Fig. 6

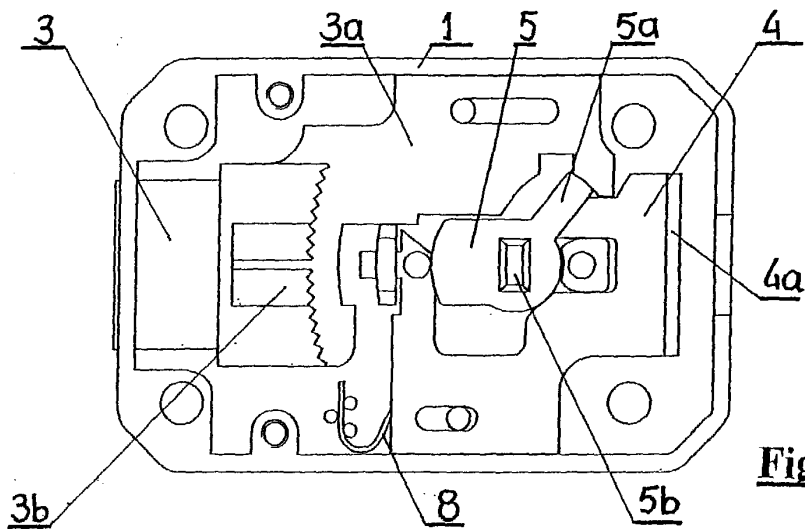


Fig. 7

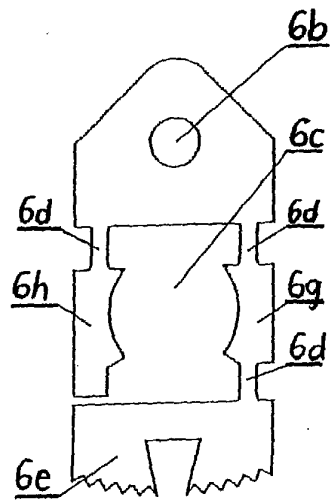


Fig. 8

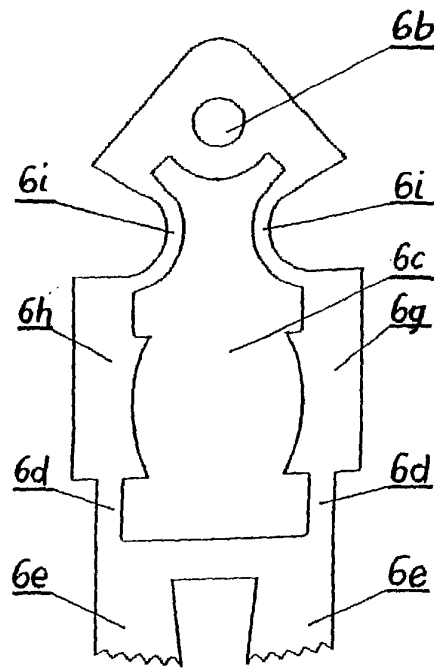


Fig. 9

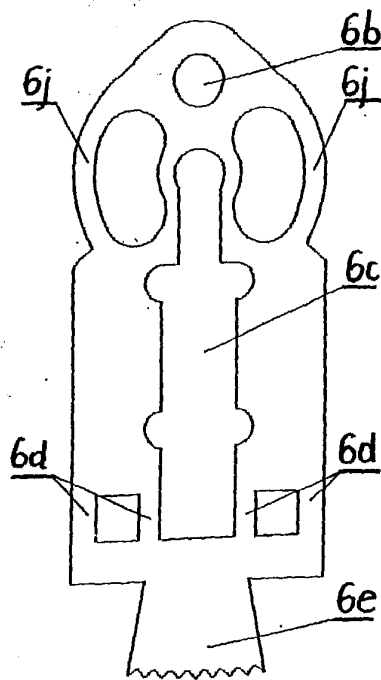


Fig. 10

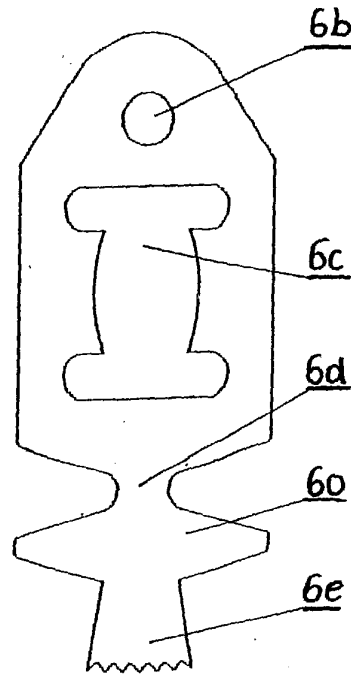


Fig. 11

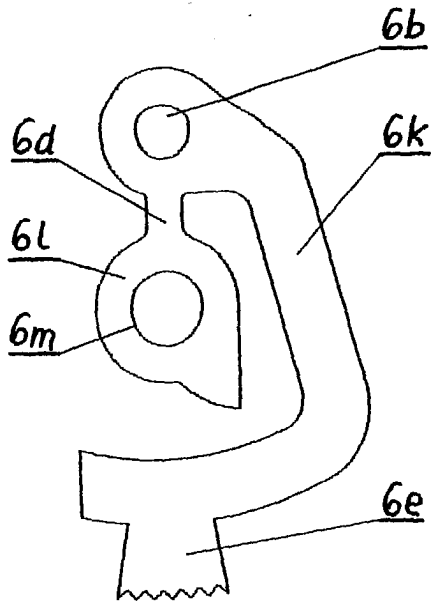


Fig. 12

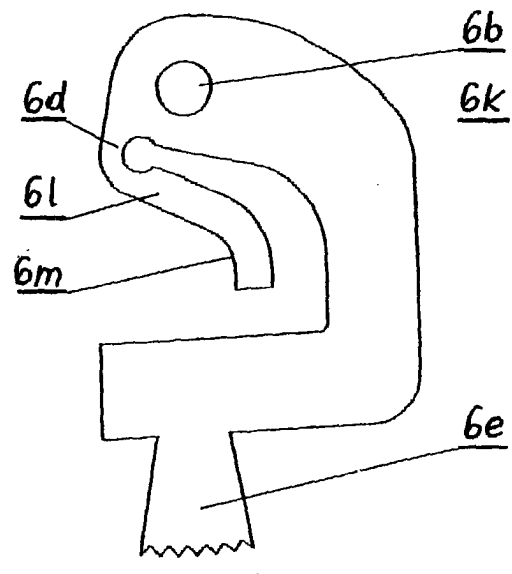


Fig. 13

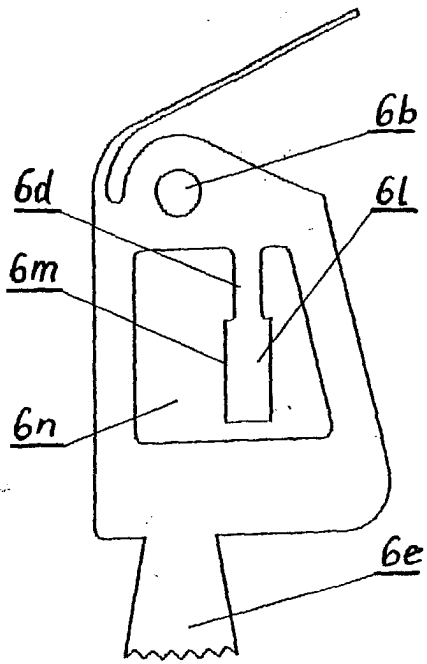


Fig. 14

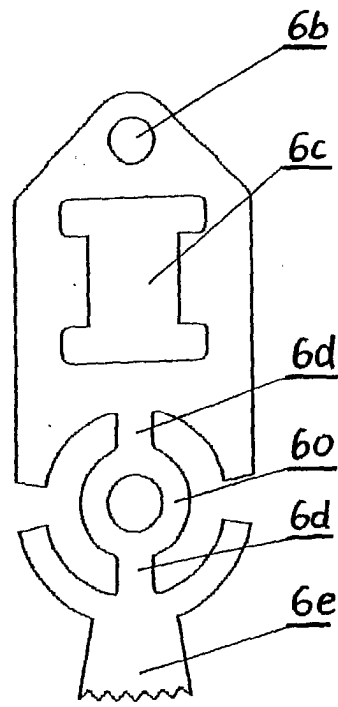


Fig. 15