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(54) **Title:** IMPROVED KEY BLANK WITH MOVEABLE ELEMENTS AND IMPROVED LOCK

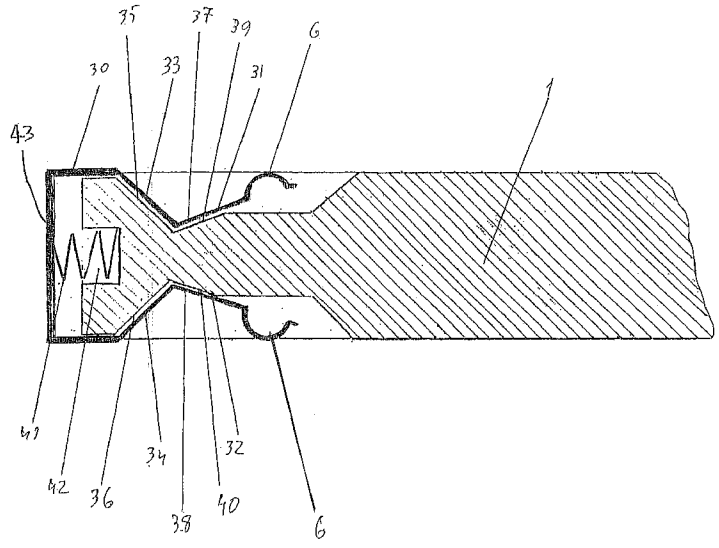

FIG. 14

(57) **Abstract:** A key comprising a key blade that includes a penetrating portion for insertion into a keyway of a lock, with at least one key combination surface for interacting with control elements of the lock, the penetrating portion comprising at lease one flexible moveable element initially in a retracted state not protruding beyond said at least one key combination surface, said at least one flexible moveable element cooperating with an actuator integral to the key the that when inserted in the keyway is actuated within the keyway and deploys said at least one flexible moveable element beyond said at least one key combination surface. A lock is also described.

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IMPROVED KEY BLANK WITH MOVEABLE ELEMENTS AND IMPROVED LOCK

FIELD OF THE INVENTION

[0001] The present invention relates to keys. More particularly, the present invention relates to an improved key blank with moveable elements and an improved lock.

BACKGROUND OF THE INVENTION

[0002] Many types of locks and keys have been fashioned in the attempt to cope with rising crime rates and to prevent intruders from breaking into the residences and properties of innocent citizens. A never-ending battle takes place in this field between the property-owners and burglars, wherein the need to improve locking systems increases as the professional abilities of the burglars increase, as well as the equipment and technological means to which they have access.

[0003] Within the framework of these efforts, innovative and sophisticated high security locks have been developed. Locks of this type generally provide security against drilling, picking and other methods of breaking in, as well as providing key duplication control, that is, protection against unauthorized duplication of keys.

[0004] Some of the mechanical high security locks utilize unique technology in which the keys include one or more moveable elements that enable the addition of elevations to the key at one or more selected points. The elevated elements of the key enable the exploitation of various systems in the lock whereby it cannot be operated without the addition of these elevations. The present invention relates to this type of lock and key.

[0005] Many types of locks and keys with elevated elements are known in the field of locks. For example, French patent No. 2,492,872 by Gsell and Girard proposes a ball or pin that is pushed to outside the key surface by means of a spring that is implanted beneath it. British patent No. 2,161,204 proposed spring-loaded elements in two directions. US patent No. 5,520,035 by Eizen and Markbreit proposed a floating element on a key that is raised by means of a spring-loaded pin that is implanted under it in the rotor. Israeli patent 129097 (1999) (PCT IL00/00164) by Weinberger proposed a raised element that is formed by means of an elastic material. DOM Security Locks

(ON, USA) marketed a key with a floating element raised by a projection from the key groove.

[0006] European patent application EP1738044 (also WO 2005/095738) by Markbreit and Ben-Aharon proposes a structure with a spring shaped like the Greek letter omega that resides in a groove that traverses the body of the key, where one arm protrudes from one side of the key, or two arms protrude simultaneously from the two sides of the key.

[0007] Keys with spring or elastic elements have a number of obvious disadvantages. The main disadvantage relates to the fact that elements that protrude from a key impede insertion of the key into the keyway of the lock. That is, when inserting the key into the keyway, an element that protrudes from it in one or more directions must be depressed into the body of the key in opposition to the spring or elastic element that is implanted beneath it in order to enable the insertion of the key into the lock. This depressing requires the application of a force on the key in order to overcome the resistance of the springs to their compression. This is especially relevant to keys described in the aforementioned EP1738044 and WO 2005/095738, where two elastic arms that protrude from two sides of the key must be depressed simultaneously in order to insert the key into the lock. Therefore, it is an object of the present invention to present an improved locking device and key in which the key includes elements that simultaneously protrude from both sides of the key but that enable easier insertion of the key into the lock.

[0008] A further disadvantage of some of the keys with elastic elements, relates to increased wear of the keyway and the pin holes bored into it. The elements that protrude from the body of the key are generally fashioned out of hard materials. This is in contrast to the soft materials, generally brass, from which most locks are fashioned. The movement of an element made of a high-strength, hard material such as spring steel applies a strong friction force on both sides of the keyway. This may be expected to lead to a large amount of wear of the keyway at the points of contact, and slipping of the arms of the omega-shaped spring in the keyway. Therefore, it is a further object of the present invention to provide an improved lock and key apparatus in which the likelihood of increased wear is substantially reduced.

[0009] In addition, it should be noted that elastic elements that protrude from a key generally lie in the plane of the pin bores in the lock. Therefore, each time that an elastic element passes the bore of a pin, it expands into it and is immediately thereafter compressed as the key continues to be inserted into the keyway. This action further aggravates the aforementioned wearing.

[0010] Furthermore, when the protruding element is located at the front end of the key, the path of its motion and friction along the keyway is especially long. Each insertion or withdrawal of the key into or from the keyway causes the two arms of the elastic element to rub against the keyway for the entire length of the keyway, back and forth. Therefore, it is a further object of the present invention to place of elastic elements that protrude in more than one direction at the front end of the key without abrading the inside of the keyway during insertion or withdrawal.

[0011] It is a further object of the present invention to provide improved locking apparatus that enables the utilization of rotor rotation control systems simultaneously from both sides of the keyway by means of two elements that are simultaneously elevated from both sides of the keyway.

[0012] Other objects and advantages of embodiments of the present invention will become apparent after reading the present specification and reviewing the accompanying figures.

SUMMARY OF THE INVENTION

[0013] There is thus provided, in accordance with embodiments of the present invention, a key including a key blade that includes a penetrating portion for insertion into a keyway of a lock, with at least one key combination surface for interacting with control elements of the lock. The penetrating portion includes at least one flexible moveable element initially in a retracted state not protruding beyond the at least one key combination surface. Said at least one flexible moveable element cooperates with an actuator integral to the key that when inserted in the keyway is actuated within the keyway and deploys said at least one flexible moveable element beyond said at least one key combination surface.

[0014] Furthermore, in accordance with embodiments of the present invention, said at least one flexible moveable element comprises two substantially opposite flexible moveable elements cooperating with the actuator.

[0015] Furthermore, in accordance with embodiments of the present invention, the actuator comprises an actuating pin inserted in the key blade extending beyond a surface of the key blade, wherein when the key blade is substantially fully inserted in the keyway, the actuating pin is pressed inward and pushes said at least one flexible moveable element outwardly.

[0016] Furthermore, in accordance with embodiments of the present invention, said at least one flexible moveable element is coupled to the actuating pin.

[0017] Furthermore, in accordance with embodiments of the present invention, the actuator is provided with a resilient element to restore the initially retracted state.

[0018] Furthermore, in accordance with embodiments of the present invention, the actuator is integral to said at least one flexible moveable element.

[0019] Furthermore, in accordance with embodiments of the present invention, said at least one flexible moveable element comprises two substantially opposite flexible moveable elements coupled to the actuator and wherein the actuator is adapted to slide over a front portion of the blade.

[0020] Furthermore, in accordance with embodiments of the present invention, the flexible moveable element is provided with a beveled surface.

[0021] Furthermore, in accordance with embodiments of the present invention, said at least one flexible moveable element comprises more than two flexible moveable elements.

[0022] Furthermore, in accordance with embodiments of the present invention, said at least one flexible moveable element includes one or more projections.

[0023] Furthermore, in accordance with embodiments of the present invention, said one or more projections are designed to cooperate with one or more control elements of the lock.

[0024] Furthermore, in accordance with embodiments of the present invention, there is provided a lock and a cooperating key combination comprising:

[0025] a lock comprising a stator and a rotor with a keyway, with control elements provided on substantially opposite sides of the keyway, and

[0026] a key comprising a key blade that includes a penetrating portion for insertion into the keyway, with at least two substantially opposite key combination surfaces for interacting with control elements of the lock, the penetrating portion comprising at least two substantially opposite flexible moveable element initially in a retracted state not protruding beyond said at least two substantially opposite key combination surfaces, said at least two flexible moveable elements cooperating with an actuator integral to the key that when inserted in the keyway is actuated within the keyway and deploys said at least two flexible moveable elements beyond said at least two key combination surfaces operating the opposite control elements of the lock.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] In order to better understand the present invention, and appreciate its practical applications, the following Figures are provided and referenced hereafter. It should be noted that the Figures are given as examples only and in no way limit the scope of the invention. Like components are denoted by like reference numerals.

[0028] Fig. 1 is a cross-sectional view of a key blank in accordance with an embodiment of the present invention, with moveable elements in a retracted state.

[0029] Fig. 2 is a cross-sectional view the key blank of Fig. 1 with moveable elements in a protruding state.

[0030] Fig. 3 is a cross-sectional view of a key blank with moveable elements in a protruding state, in accordance with an embodiment of the present invention, with a spring for re-extending the actuating pin that deploys the moveable elements.

[0031] Fig. 4 is a cross-sectional view of a key blank with moveable elements in a protruding state in accordance with an embodiment of the present invention, the moveable elements being so shaped as to re-extend the actuating pin.

[0032] Fig. 5 is a cross-sectional view of a key blank in accordance with an embodiment of the present invention, in which the actuating pin includes sloped surfaces for pressing on the moveable elements.

[0033] Fig. 6 is a cross-sectional view of a key blank in accordance with an embodiment of the present invention, with moveable elements in a retracted state that are connected to the actuating pin.

[0034] Fig. 7 is a cross-sectional view of the key blank of Fig. 6 with moveable elements in a protruding state.

[0035] Fig. 8 is a cross sectional view of a lock and partially inserted key in accordance with an embodiment of the present invention, with moveable elements in a retracted state, the rotor being immobilized.

[0036] Fig. 9 is a cross sectional view of the lock of Fig. 8 and a fully inserted key with moveable elements in a protruding state, the rotor capable of being turned.

[0037] Fig. 10 is a cross sectional view of a lock and partially inserted key in accordance with an embodiment of the present invention, with moveable elements in a retracted state and double-sided system of pins, the rotor being immobilized.

[0038] Fig. 11 is a cross sectional view of the lock of Fig. 10 and a fully inserted key with moveable elements in a protruding state on both sides, the rotor capable of being turned.

[0039] Fig. 12 is a cross-sectional view of a key blank including a single moveable element in its retracted state, in accordance with an embodiment of the present invention.

[0040] Fig. 13 is a side view of a cross section of a key blank with three moveable elements in their retracted state, in accordance with an embodiment of the present invention.

[0041] Fig. 14 is a cross-sectional view of a key blank with integrated moveable elements that includes moveable elements in their retracted state and a deploying element, in accordance with an embodiment of the present invention.

[0042] Fig. 15 is an orthogonal side view of the key blank shown in Fig 14.

[0043] Fig. 16 is a cross-sectional view of the key blank shown in Fig. 14, with integrated moveable elements that include moveable elements in their protruding state and a deploying element.

DETAILED DESCRIPTION OF EMBODIMENTS

[0044] A key fashioned in accordance with embodiments of the present invention includes moveable elements that are ordinarily retracted to within the bounds defined by the outer surface of the key. In particular, during most of the movement of the key into or out of a keyway, the moveable elements are retracted. In order to cause the moveable elements to protrude beyond the outer surface of the key, a force must be applied to a deploying element pin located on the leading end of the key or on other surface of the key. A force may be applied to the deploying element by the wall of the keyway most distal to the keyway opening. Such a force is only applied when the key is fully, or substantially fully, inserted into the keyway. Thus, the moveable elements of the key protrude beyond the outer surface of the key only when it is necessary that they do so.

[0045] A key fashioned in accordance to embodiments of the present invention overcomes disadvantages related to keys that incorporate elastic elements. The disadvantages of such keys are related to movement of such a key into and out of a keyway. Such disadvantages stem from the fact that the elastic elements ordinarily protrude beyond the outer surface of such key. Movement of such a key in a keyway requires the application of an inward force. Such an inward force is applied by the keyway during insertion and withdrawal of the key, and resists the movement of such a key in a keyway.

[0046] Embodiments of the present invention may be better understood with reference to the Figures and the accompanying description. It should be understood that the Figures are provided for explanation only, and should not be construed as limiting the scope of the invention.

[0047] Fig. 1 is a cross-sectional view of a key blank in accordance with an embodiment of the present invention, with moveable elements in a retracted state. The key blank includes key blade 1. Key blade 1 includes front end 2. Channel 9 traverses

key blade 1 from one side of key blade 1 to the other. Channel 9 is located near front end 2 of key blade 1. Moveable elements 3 and 4 are made of flexible elastic material. Moveable elements 3 and 4 are affixed to opposite sides of key blade 1 for example by means of pins 8. Alternatively, moveable elements 3 and 4 may be affixed to key blade 1 by any other suitable means, including, but not limited to, nails, screws, adhesion, pressure, or threading.

[0048] Each moveable element 3 or 4 is affixed to key blade 1 in such a manner that one end is held fast to key blade 1. Free ends 7 of moveable elements 3 and 4 are bent inward into channel 9 and toward one another. Moveable elements 3 and 4 include shaped projections 6. The form of shaped projections 6 shown in the Figures is for illustration purposes only. Shaped projections 6 may be of any shape. When moveable elements 3 and 4 are retracted, shaped projections 6 lie completely within the outer surface of key blade 1. Therefore, with moveable elements 3 and 4 retracted, key blade 1 may be moved into or out of a keyway (not shown in Fig. 1, but labeled 27 in Fig. 8) without interference by shaped projections 6.

[0049] Alternatively, a key may be provided with only one moveable element. Fig. 12 is a cross-sectional view of a key blank including a single moveable element in its retracted state, in accordance with an embodiment of the present invention. In this embodiment, only single moveable element 3 is affixed to key blade 1.

[0050] An actuator in the form of actuating pin 5 fits into bore 15 in front end 2 of key blade 1. Actuating pin 5 is free to move back and forth within bore 15. Unless pressed inward, actuating pin 5 projects beyond front end 2 of key blade 1. Actuating pin 5 will be pressed inward, for example, when key blade 1 is almost fully inserted into a keyway (not shown). When almost fully inserted into a keyway, pin 5 may come into contact with a keyway wall facing front end 2. Further insertion of key blade 1 into the keyway causes the keyway wall to press pin 5 inward.

[0051] Fig. 2 is a cross-sectional view the key blank of Fig. 1 with moveable elements in a protruding state. When pressed inward, actuating pin 5 slides into channel 9. Free ends 7 of moveable elements 3 and 4 are sloped or beveled. The slope of free ends 7 is such that when actuating pin 5 is pressed into channel 9 and against free ends 7, free ends 7 are pushed away from one another and toward the outer surface of key blade 1.

This outward movement of free ends 7 deploys moveable elements 3 and 4 with shaped projections 6 outward, so that shaped projections 6 protrude beyond the outer surface of key blade 1.

[0052] When protruding beyond the outer surface of key blade 1, shaped projections 6 may actuate various control mechanisms in the rotor and stator of a lock. Fig. 8 is a cross sectional view of a lock and partially inserted key in accordance with an embodiment of the present invention, with moveable elements in a retracted state, the rotor being immobilized. The lock has a standard structure with a system of spring-loaded pins. In the embodiment illustrated in Fig. 8, the lock is actuated by a key that includes a protruding element on one side.

[0053] Lock 24 includes stator 25 and rotor 26. Rotor 26 includes keyway 27 into which key blade 1 is partially inserted. Lock 24 is provided with lock pin assemblies 51a, 51b and 51c. Each of the lock pin assemblies 51a, 51b and 51c is divided by gap 52a, 52b, and 52c respectively. Springs 50 push lock pin assemblies 51a, 51b, and 51c in the direction of keyway 27. Key blade 1 impedes the movement of lock pin assemblies 51a, 51b and 51c. Only when all gaps 52a, 52b and 52c align with shear line 53 between rotor 26 and stator 25, is rotor 26 free to rotate.

[0054] As shown in Fig. 8, gaps 52a, 52b, and 52c do not align with shear line 53. As viewed from keyway 27, gaps 52b and 52c are distal to shear line 53, while gap 52a is proximal to shear line 53. Therefore, in order that rotor 26 be free to rotate, the shape of key blade 1 must be such as to allow lock pin assemblies 51b and 51c to partially enter keyway 27. Such shaping is provided by depressions 54 on key blade 1. On the other hand, a protruding element must be provided to push lock pin assembly 51a back away from keyway 27. Such an opposing force may be provided by shaped projection 6 of moveable element 4.

[0055] Fig. 9 is a cross sectional view of the lock of Fig. 8 and a fully inserted key with moveable elements in a protruding state, the rotor capable of being turned. Blade 1 is fully inserted into keyway 27 of lock 24. Pin 5 extends into channel 9 and forcing moveable element 4 outward. Shaped projection 6 of moveable element 4 protrudes outward, pushing lock pin assembly 51a away from keyway 27. Gaps 52a, 52b, and 52c now align with shear line 53 between rotor 26 and stator 25. Moveable element 3, on the

other hand, is confined to channel 9 by the walls of keyway 27. A torque applied to key bow 14 then causes rotor 26 to turn, enabling operation of lock 24.

[0056] Shaped projections 6 may actuate more than one control mechanism simultaneously, each on a different side of key blade 1. Fig. 10 is a cross sectional view of a lock and partially inserted key in accordance with an embodiment of the present invention, with moveable elements in a retracted state and double-sided system of pins, the rotor being immobilized. In this embodiment, in addition to lock pin assemblies 51a, 51b, and 51c, lock 24 is provided with lock pin assembly 28 on the opposite side of key blade 1. Key blade 1 is partially inserted into keyway 27, and gaps 52a, 52b, 52c, and 52d do not align with shear line 53. Fig. 11 is a cross sectional view of the lock of Fig. 10 and a fully inserted key with moveable elements in a protruding state on both sides, the rotor capable of being turned. Key blade 1 is fully inserted into keyway 27. Actuating pin 5 is pushed inward, deploying moveable elements 3 and 4 outward. Shaped projections 6a and 6b push outward against lock pin assemblies 51a and 28 respectively. Gaps 52a, 52b, 52c, and 52d align with shear line 53. Therefore, rotor 26 is free to rotate within stator 25, allowing lock 24 to open.

[0057] It should be understood that shaped projections 6a and 6b may vary from one another in their shapes, the amount by which they protrude beyond the outer surface of key blade 1, and in their positions along the length of key blade 1. Shaped projections 6a and 6b and moveable elements 3 and 4 need not be located on opposite faces of key blade 1, but may be positioned on adjacent faces. In this case, the key must be inserted into the keyway with a specific orientation in order to unlock the lock. Alternatively, moveable elements may be fashioned symmetrically so that the key may be inserted into the keyway in any of several orientations.

[0058] In embodiments of the present invention, a key may be provided with more than two moveable elements. Each moveable element may project from a different face of the key blade. Fig. 13 is a side view of a cross section of a key blank with three moveable elements in their retracted state, in accordance with an embodiment of the present invention. In addition to moveable elements 3 and 4 attached to the sides of key blade 1, moveable element 55 is attached the top of key blade 1 and is viewed from above. As shown, all moveable elements are retracted into channel 9.

[0059] Fig. 3 is a cross-sectional view of a key blank with moveable elements in a protruding state, in accordance with an embodiment of the present invention, with a spring for re-extending the actuating pin that deploys the moveable elements. Fig. 3 is a cross-sectional view of an embodiment of the present invention in which a spring provides a restoring force. In this embodiment, spring 16 is held in place within channel 9. Spring 16 is held in place by support pin 18 extending from key blade 1, and support pin 17 extending from actuating pin 5. It will be clear to one skilled in the art that spring 16 may be replaced with any other resilient compressible element capable of applying a restoring force. It will be clear to one skilled in the art that one or both of support pins 16 and 17 may be replaced with indentations or any other means of holding such a compressible element in place. When actuating pin 5 is pressed inward, deploying moveable elements 3 and 4 outward, spring 16 is compressed. When inward pressure on actuating pin 5 is released, such as when key blade 1 is being removed from a keyway, spring 16 applies a restoring force on actuating pin 5 that pushes actuating pin 5 outward. Actuating pin 5 is pushed outward to its initial position (as shown in Fig. 1) where actuating pin 2 extends beyond front surface 2 of key blade 1. When actuating pin 5 is pushed outward and out of channel 9, free ends 7 of moveable elements 3 and 4 are free to move inward, into channel 9. The elasticity of moveable elements 3 and 4 causes free ends 7 and shaped projections 6 to bend back into channel 9. Shaped projections 6 are then re-retracted to within the outer surface of key blade 1. Actuating pin 5 and key blade 1 are provided with structure known to those skilled in the art (not shown) that limits the outward movement of actuating pin 5. This limiting structure prevents an applied restoring force from causing actuating pin 5 to become entirely detached from bore 15 in key blade 1.

[0060] Fig. 4 is a cross-sectional view of a key blank with moveable elements in a protruding state in accordance with an embodiment of the present invention, the moveable elements being so shaped as to re-extend the actuating pin. In this embodiment, the elasticity of moveable elements 3 and 4 themselves provides the force for restoring the retracted state. The free ends of moveable elements 3 and 4 are provided with elongated sloped surfaces 19. When inward pressure on pin 5 is released, the elasticity of moveable elements 3 and 4 applies a force that causes sloped surfaces

19 to bend toward one another. Sloped surfaces 19 cause part of the bending force to be applied as a restoring force on actuating pin 5, pushing actuating pin 5 out of channel 9.

[0061] Fig. 5 is a cross-sectional view of a key blank in accordance with an embodiment of the present invention, in which the actuating pin includes sloped surfaces for pressing on the moveable elements. Pin 5 is provided with beveled surfaces 20. Beveled surfaces 20 reduce the amount of inward force that must be applied to the front end of actuating pin 5 in order to deploy moveable elements 3 and 4 outward.

[0062] Fig. 6 is a cross-sectional view of a key blank in accordance with an embodiment of the present invention, with moveable elements in a retracted state that are connected to the actuating pin. In this embodiment, elastic element 22 connects to actuating pin 5 at connection point 11. The wall of channel 9 opposite actuating pin 5 is provided with a sloped projection 12. Elastic element 22 includes one or more elastic arms 23 with shaped projections 10. Free ends 13 of elastic arms 23 are sloped or beveled. When no inward force is applied to actuating pin 5, elastic arms 23 bend inward and shaped projections 10 do not extend beyond the outer surface of key blade 1. When an inward force is applied to actuating pin 5, free ends 13 come into contact with the surface of sloped projection 12. Inward motion of actuating pin 5 causes free ends 13 to slide along the surface of sloped projection 12 in a direction away from front surface 2. The shape of sloped projection 12 causes free ends 13 to bend outward, thus causing elastic arms 23 to deploy outward. Fig. 7 is a cross-sectional view of the key blank of Fig. 6 with moveable elements in a protruding state. Outward deployment of elastic arms 23 extends shaped projections 10 so that they protrude beyond the outer surface of key blade 1.

[0063] In another embodiment of the present invention, the actuating pin is replaced by an actuator in the form of an element that is incorporated into the moveable element itself. Fig. 14 is a cross-sectional view of a key blank with integrated moveable elements that includes moveable elements in their retracted state and a deploying element, in accordance with an embodiment of the present invention. Moveable element 30 includes flexible arms 31 and 32, containing shaped projections 6. A resilient compressible element, such as a spring 41 that is located in bore 42 in the front portion of the key blade 1, extends to actuating surface 43 of moveable element 30. When

spring 41 is maximally extended, inwardly sloping surfaces 35 and 36 of key blade 1 prevent sloped sections 33 and 34 from moveable outward, keeping moveable element 30 attached to key blade 1. The elasticity of flexible arms 31 and 32 maintains shaped projections 6 retracted within the bounds defined by the outer surface of key blade 1. As shown, the front end of moveable element 30 extends sideways beyond the outer surface of key blade 1. Alternatively, the front portion of key blade 1 may be so shaped, for example with a groove, so that the outer surface of moveable element is flush with the outer surface of key blade 1. Alternatively, the integrated moveable elements may be partially or fully embedded in the key blade.

[0064] Fig. 15 is an orthogonal side view of the key blank shown in Fig 14. When shaped projections 6 are retracted, key blade 1 may be inserted into a keyway without substantial resistance.

[0065] Fig. 16 is a cross-sectional view of the key blank shown in Fig. 14, with integrated moveable elements that include moveable elements in their protruding state and a deploying element. When key blade 1 is fully inserted into the keyway, actuating surface 43 comes into contact with the inner wall of the keyway. Further insertion of key blade 1 into the keyway causes the inner wall of the keyway to apply a compression force to actuating surface 43. The compression force causes spring 41 to compress. The compression force applied to actuating surface 43 causes outwardly sloping sections 37 and 38 of flexible arms 31 and 32, respectively, to slide against beveled surfaces 39 and 40, respectively, of key blade 1. The sliding motion of outwardly sloping sections 37 and 38 against beveled surfaces 39 and 40 deploys flexible arms 31 and 32 outward. Outward deployment of flexible arms 31 and 32 causes shaped projections 6 to protrude beyond the outer surface of key blade 1. When shaped projections 6 protrude beyond the outer surface of blade one, they may actuate control elements in a lock, allowing the lock to open.

[0066] Partial withdrawal of key blade 1 from the keyway reduces the compression force on actuating surface 43. When the compression force on actuating surface 43 is reduced, spring 41 is free to push actuating surface 43 and moveable element 30 outward. Outward motion of moveable element 30 allows the elasticity of flexible arms 31 and 32 to bend flexible arms 31 and 32 inward. Inward bending of flexible arms 31

and 32 retracts shaped projections 6 to within the outer surface of key blade 1. Retraction of shaped projections 6 allows the removal of key blade 1 from the keyway without interference. Alternatively, flexible arms 31 and 32, and the surface of key blade 1, may be so shaped such that the elasticity of flexible arms 31 and 32 forces actuating surface 43 outward and retracts shaped projections 6 inward.

[0067] Moveable element 30 may be fashioned so that its thickness varies from section to section, so that those parts that are to permanently retain their shape do so, while flexible parts are free to bend. Alternatively, the material from which the various parts of moveable element 30 are fashioned may be varied so that each part is made of material with appropriate stiffness or flexibility.

[0068] It is noted that in various embodiments of the present invention the actuating pin, the actuating surface of the integrated moveable elements or another actuator of the moveable elements may be positioned on other surfaces of the key, where it can be actuated inside the keyway. Alternatively the actuator may be placed internally in the key blade, with a corresponding protrusion inside the keyway that cooperates with it.

[0069] It should be clear that the description of the embodiments and attached Figures set forth in this specification serves only for a better understanding of the invention, without limiting its scope.

[0070] It should also be clear that a person skilled in the art, after reading the present specification could make adjustments or amendments to the attached Figures and above described embodiments that would still be covered by the present invention.

CLAIMS

1. A key comprising:

a key blade that includes a penetrating portion for insertion into a keyway of a lock, with at least one key combination surface for interacting with control elements of the lock, the penetrating portion comprising at least one flexible moveable element initially in a retracted state not protruding beyond said at least one key combination surface, said at least one flexible moveable element cooperating with an actuator integral to the key that when inserted in the keyway is actuated within the keyway and deploys said at least one flexible moveable element beyond said at least one key combination surface.

2. The key as claimed in claim 1, wherein said at least one flexible moveable element comprises two substantially opposite flexible moveable elements cooperating with the actuator.

3. The key as claimed in claim 1, wherein the actuator comprises an actuating pin inserted in the key blade extending beyond a surface of the key blade, wherein when the key blade is substantially fully inserted in the keyway, the actuating pin is pressed inward and pushes said at least one flexible moveable element outwardly.

4. The key as claimed in claim 3, wherein said at least one flexible moveable element is coupled to the actuating pin.

5. The key as claimed in claim 1, wherein the actuator is provided with a resilient element to restore the initially retracted state.

6. The key as claimed in claim 1, wherein the actuator is integral to said at least one flexible moveable element.

7. The key as claimed in claim 6, wherein said at least one flexible moveable element comprises two substantially opposite flexible moveable elements coupled to the actuator and wherein the actuator is adapted to slide over a front portion of the blade.

8. The key as claimed in claim 1, wherein the flexible moveable element is provided with a beveled surface.

9. The key as claimed in claim 1, wherein said at least one flexible moveable element comprises more than two flexible moveable elements.

10. The key as claimed in claim 1, wherein said at least one flexible moveable element includes one or more projections.

11. The key as claimed in claim 10, wherein said one or more projections are designed to cooperate with one or more control elements of the lock.

12. A lock and a cooperating key combination comprising

a lock comprising a stator and a rotor with a keyway, with control elements provided on substantially opposite sides of the keyway, and

a key comprising a key blade that includes a penetrating portion for insertion into the keyway, with at least two substantially opposite key combination surfaces for interacting with control elements of the lock, the penetrating portion comprising at least two substantially opposite flexible moveable element initially in a retracted state not protruding beyond said at least two substantially opposite key combination surfaces, said at least two flexible moveable elements cooperating with an actuator integral to the key that when inserted in the keyway is actuated within the keyway and deploys said at least two flexible moveable elements beyond said at least two key combination surfaces operating the opposite control elements of the lock.

13. A lock comprising a stator and a rotor with a keyway, with control elements provided on substantially opposite sides of the keyway, wherein the opposite control elements are designed to be operated by a key with two substantially opposite moveable elements adapted to protrude concurrently beyond two opposite key combination surfaces of the key.

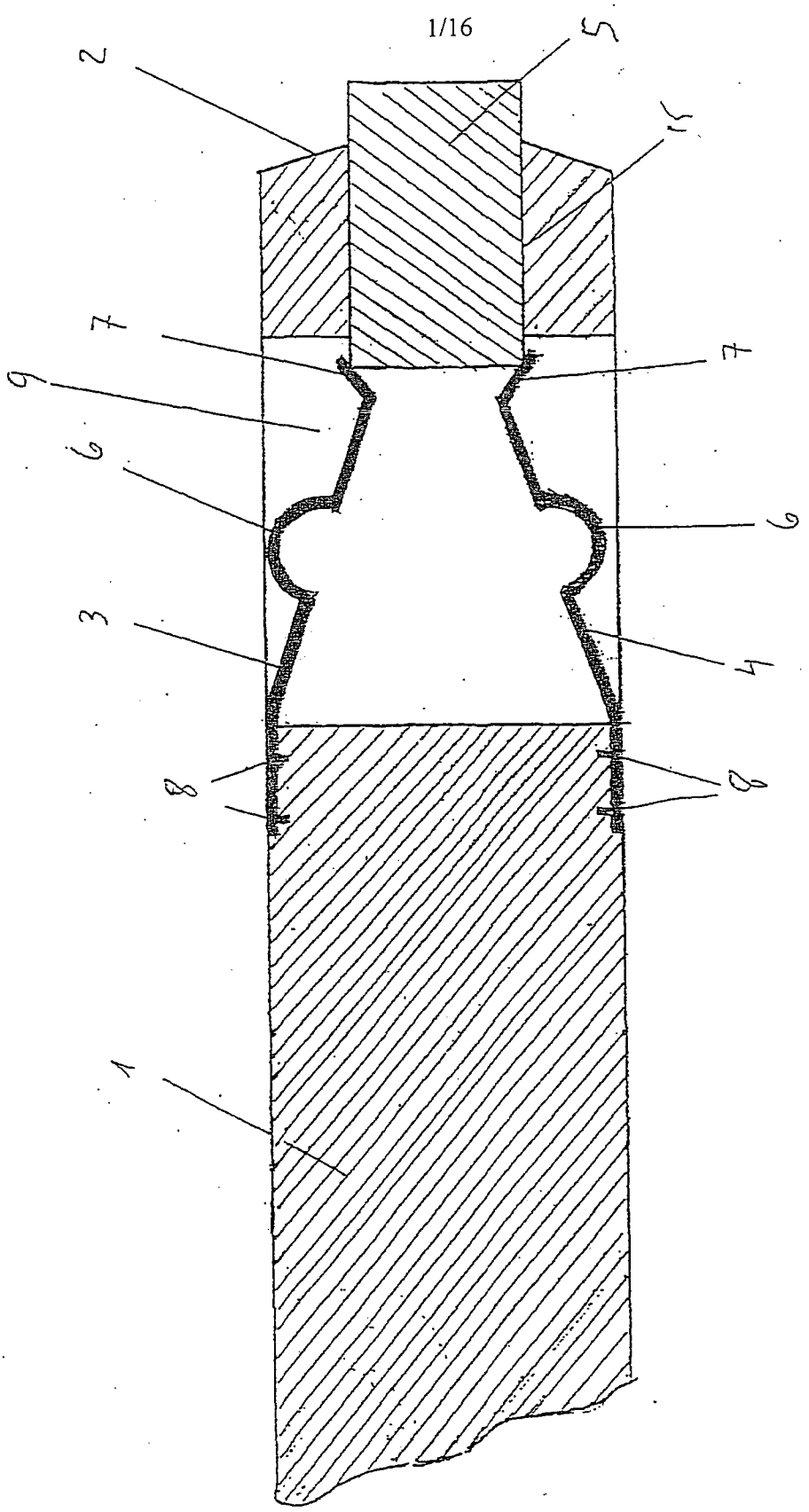

FIG. 1

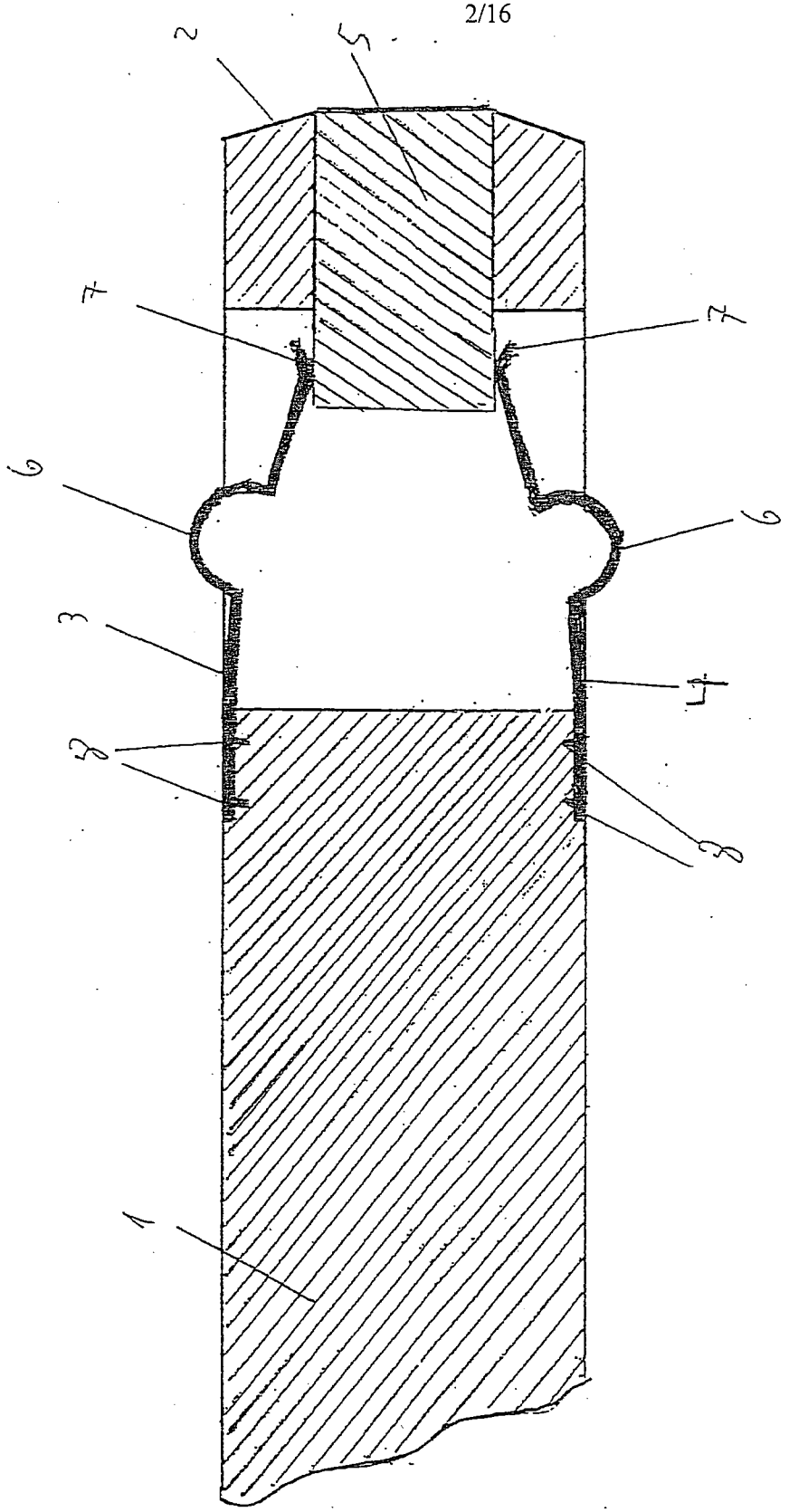

FIG. 2

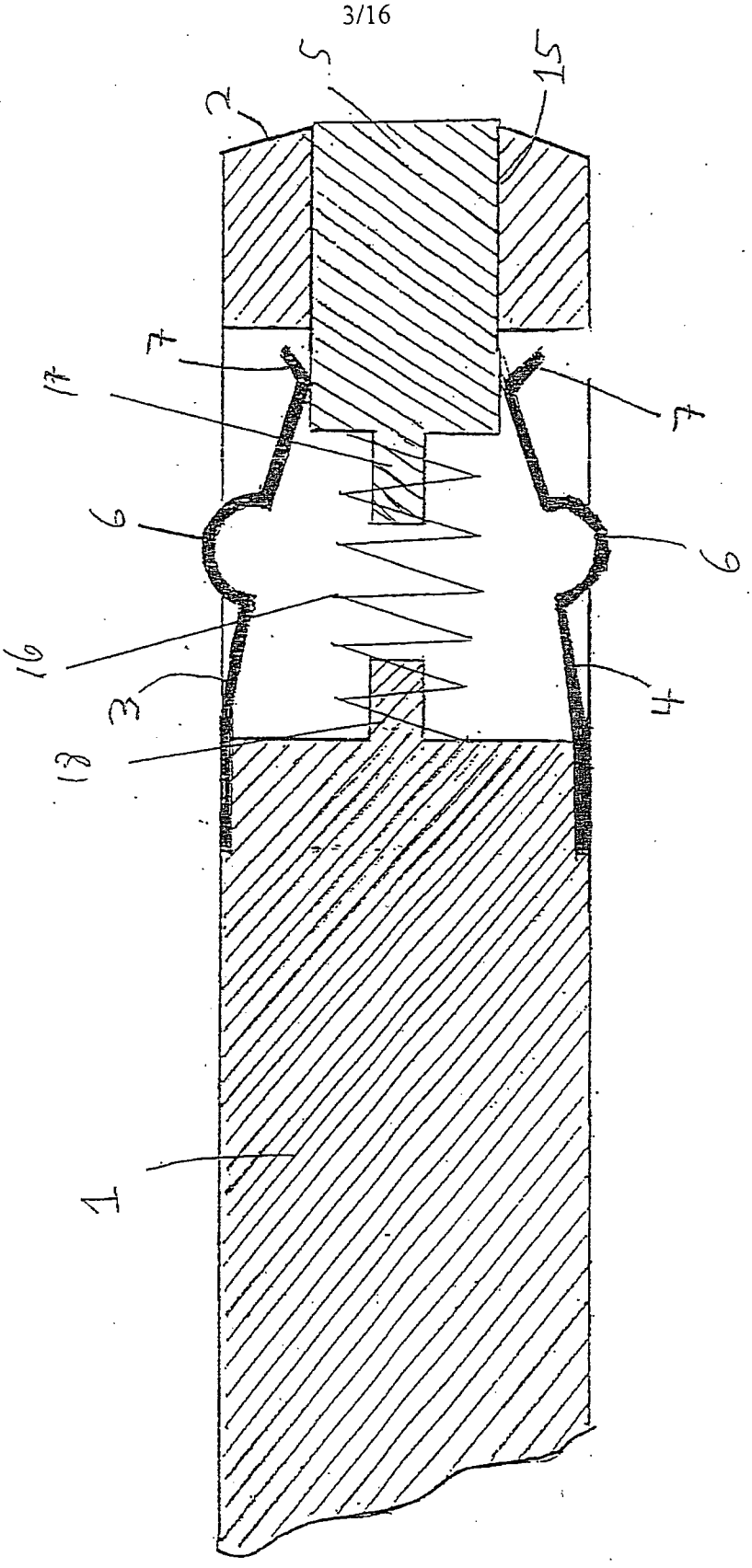

FIG 2

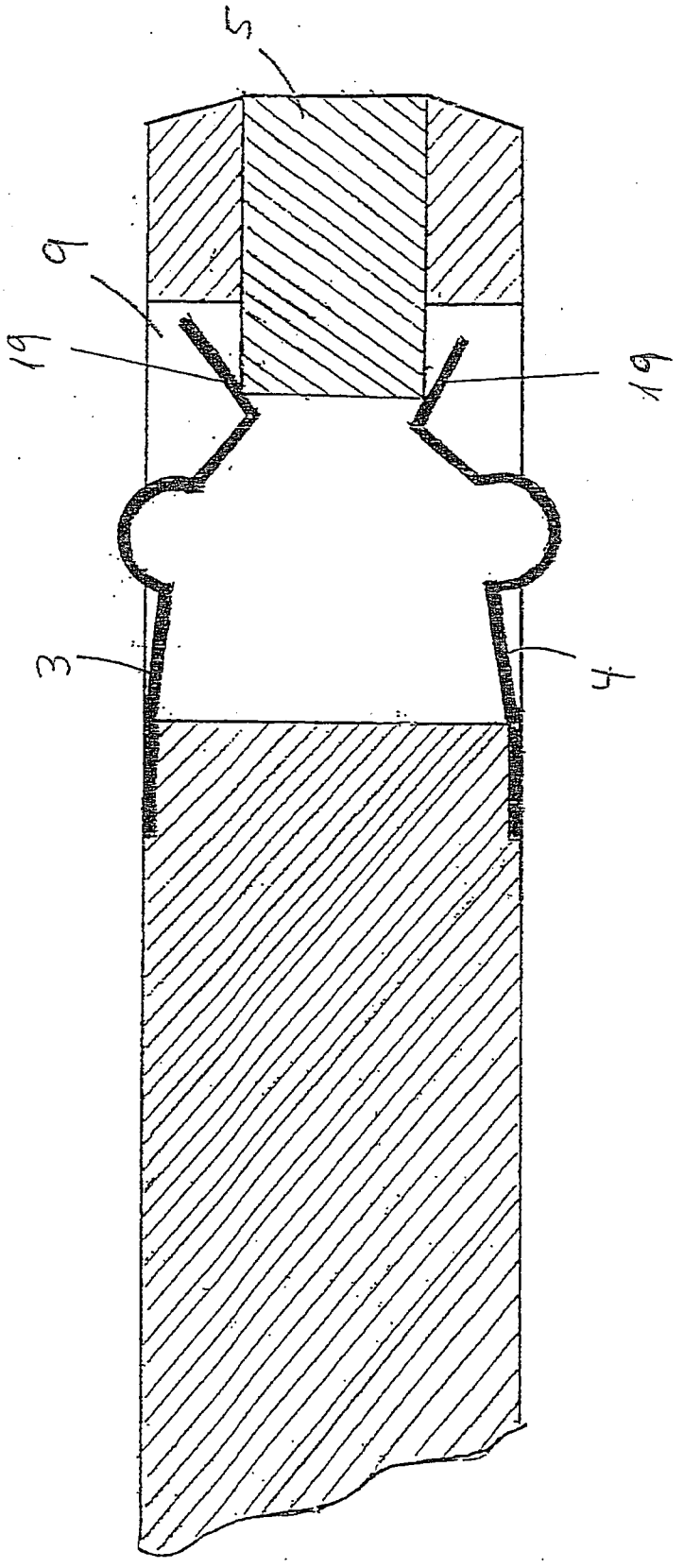

FIG. 4

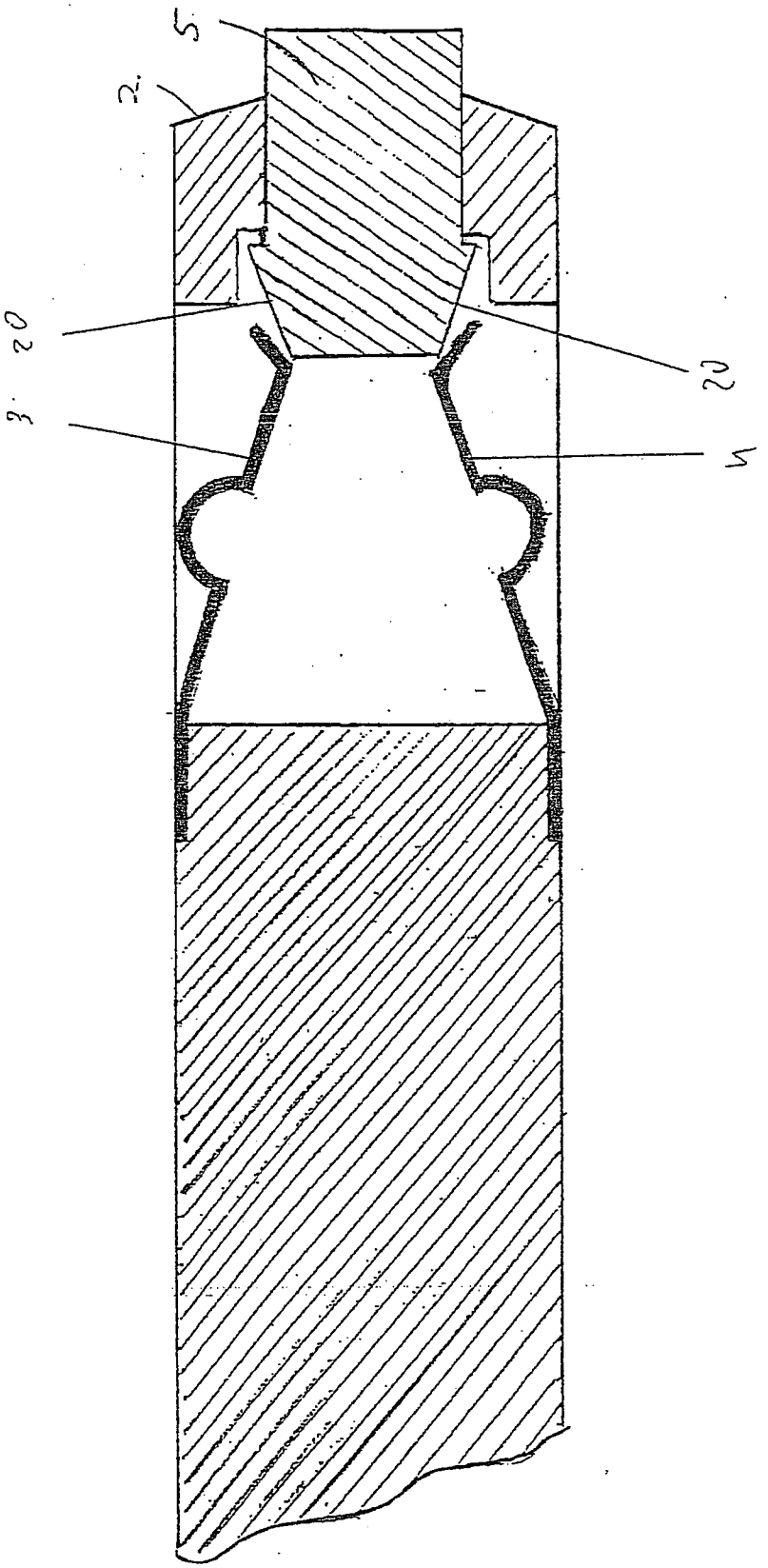

Fig 1

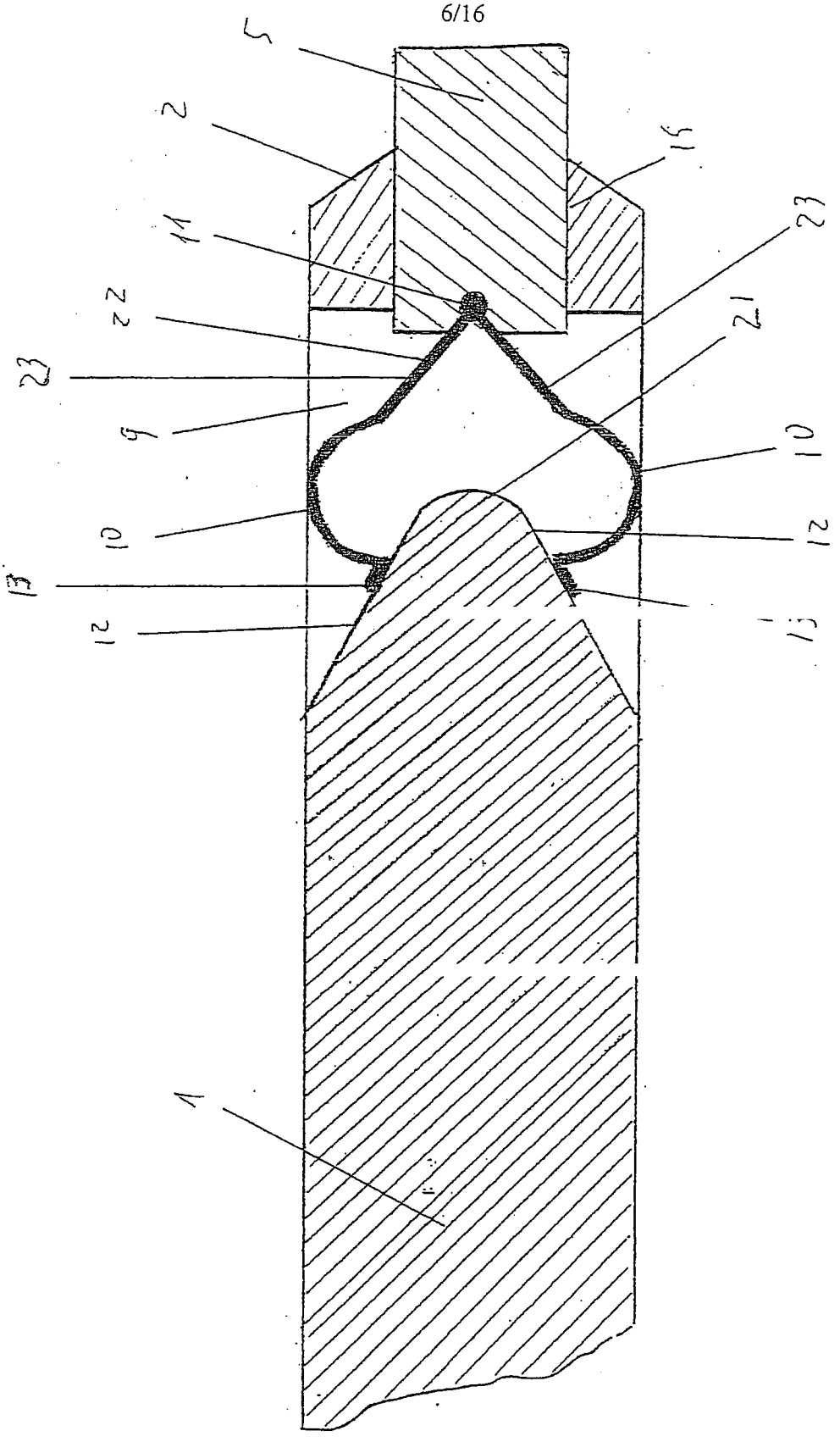

FIG 6

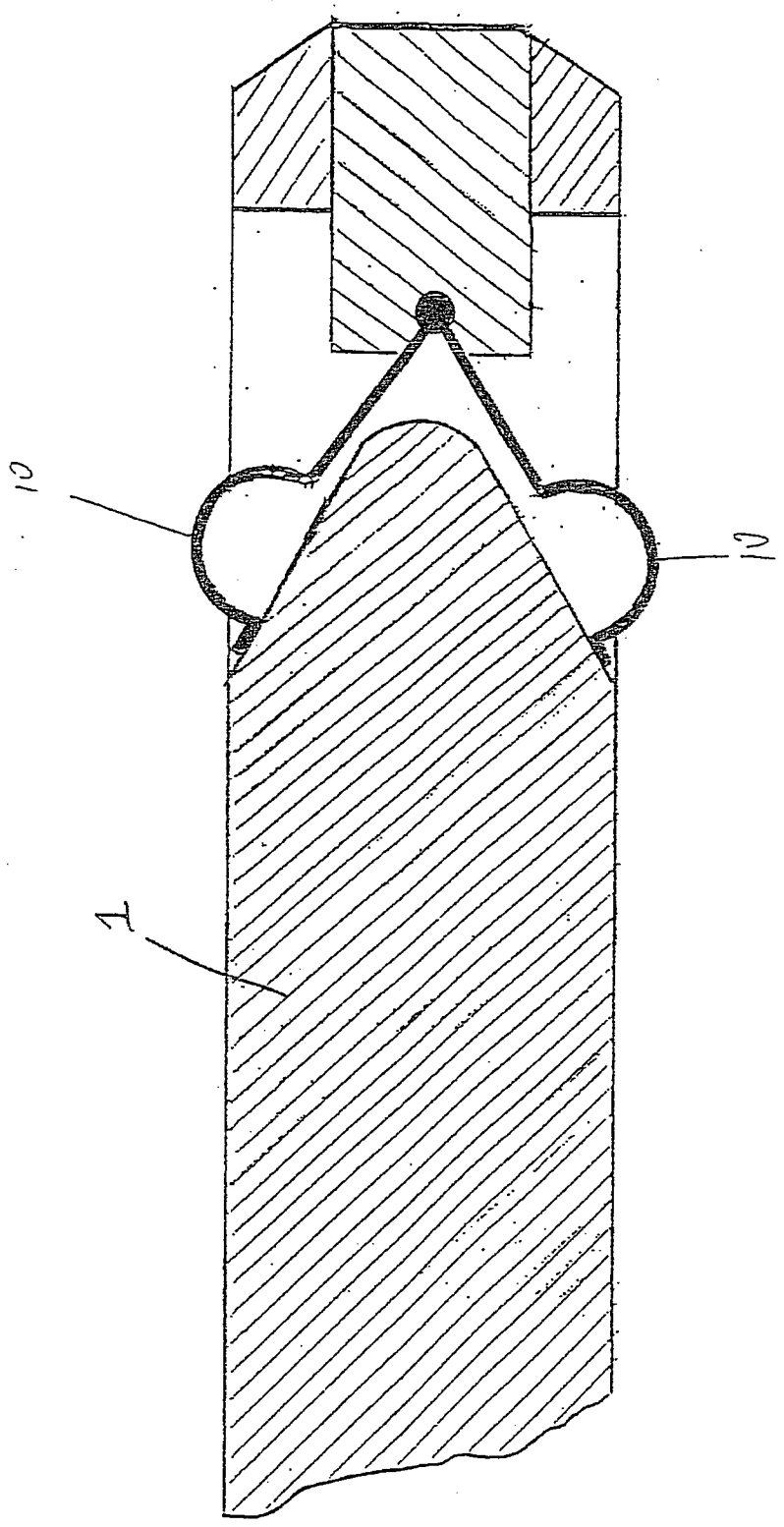

FIG 7

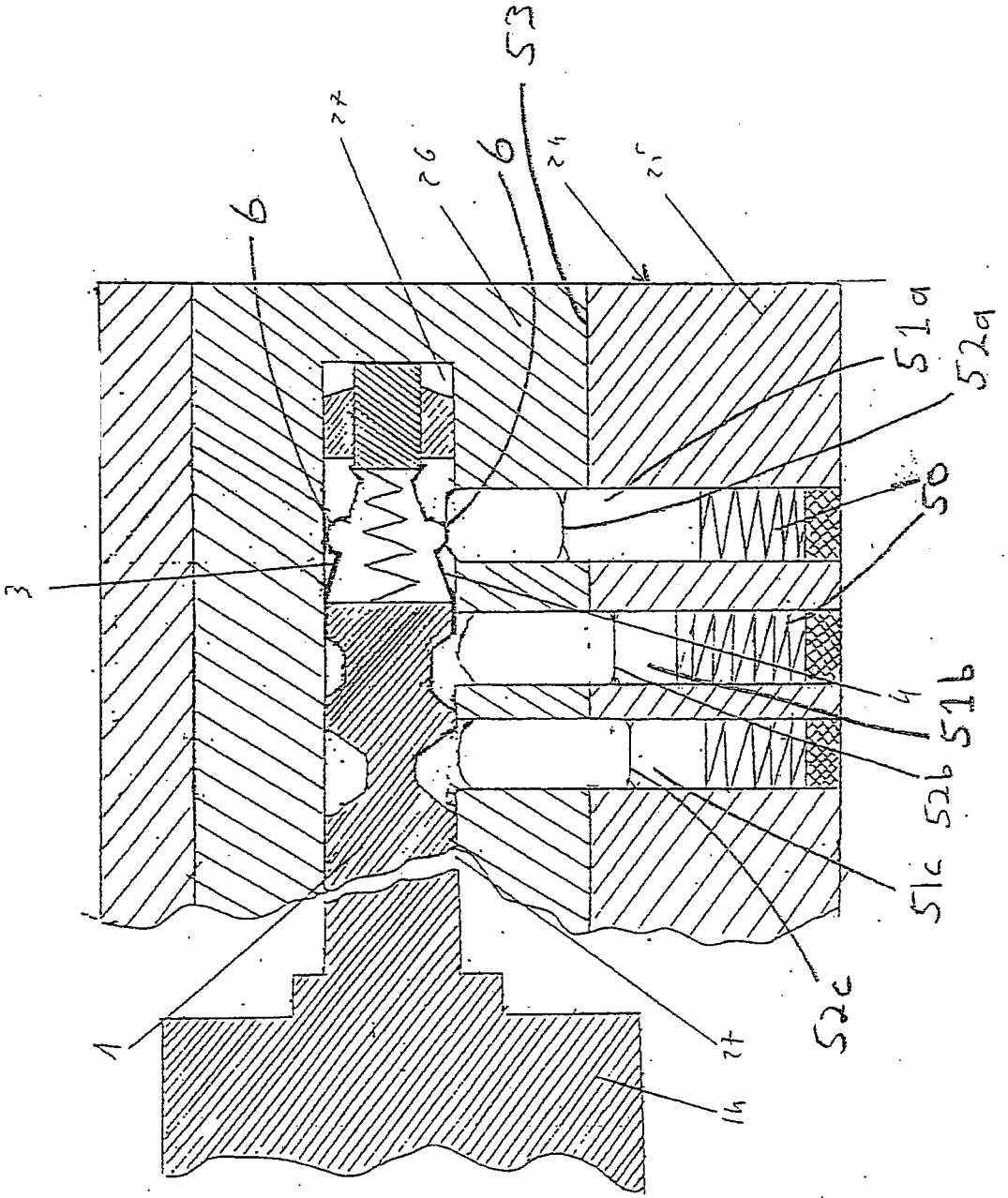

FIG. 8

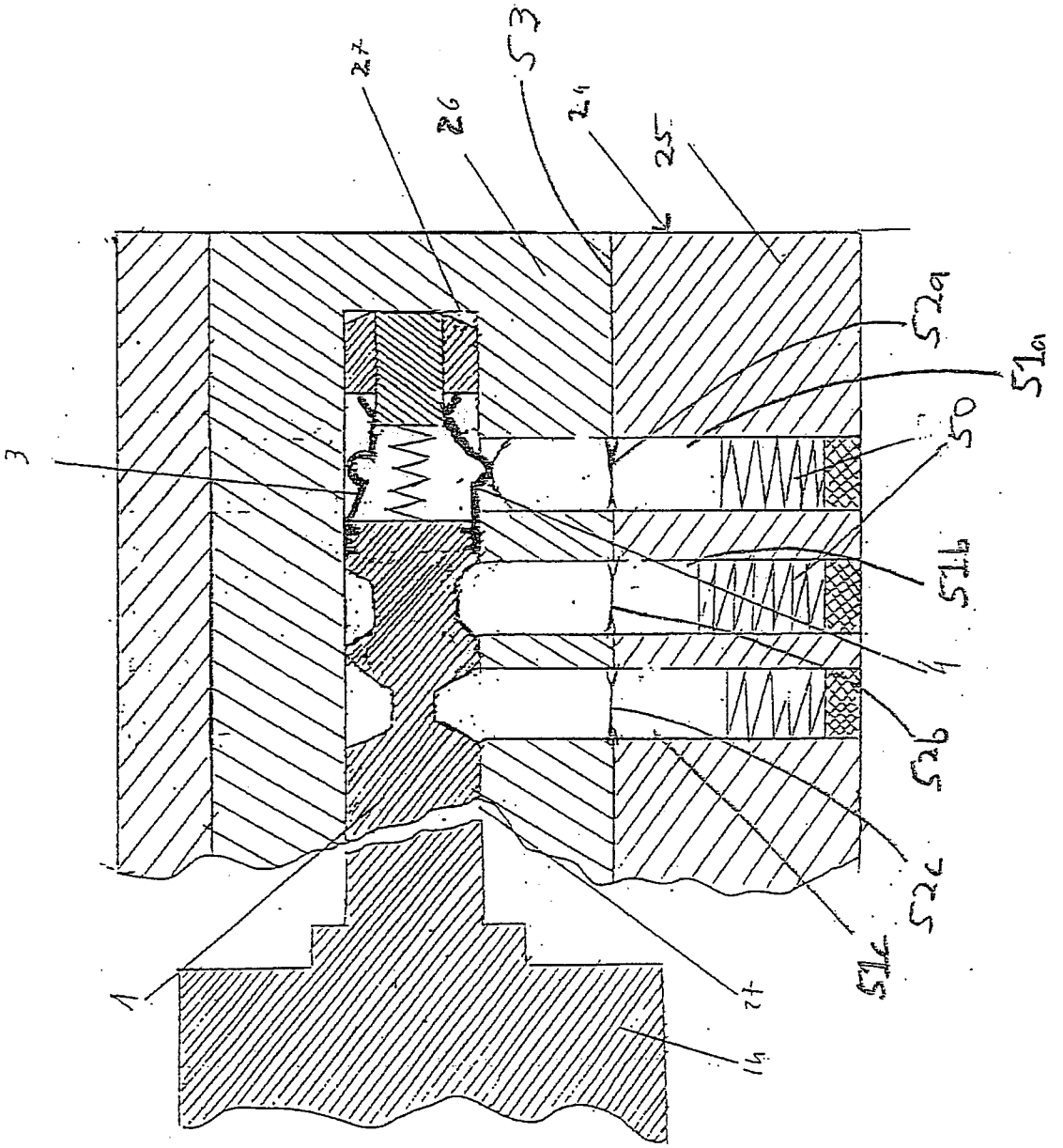

FIG. 9

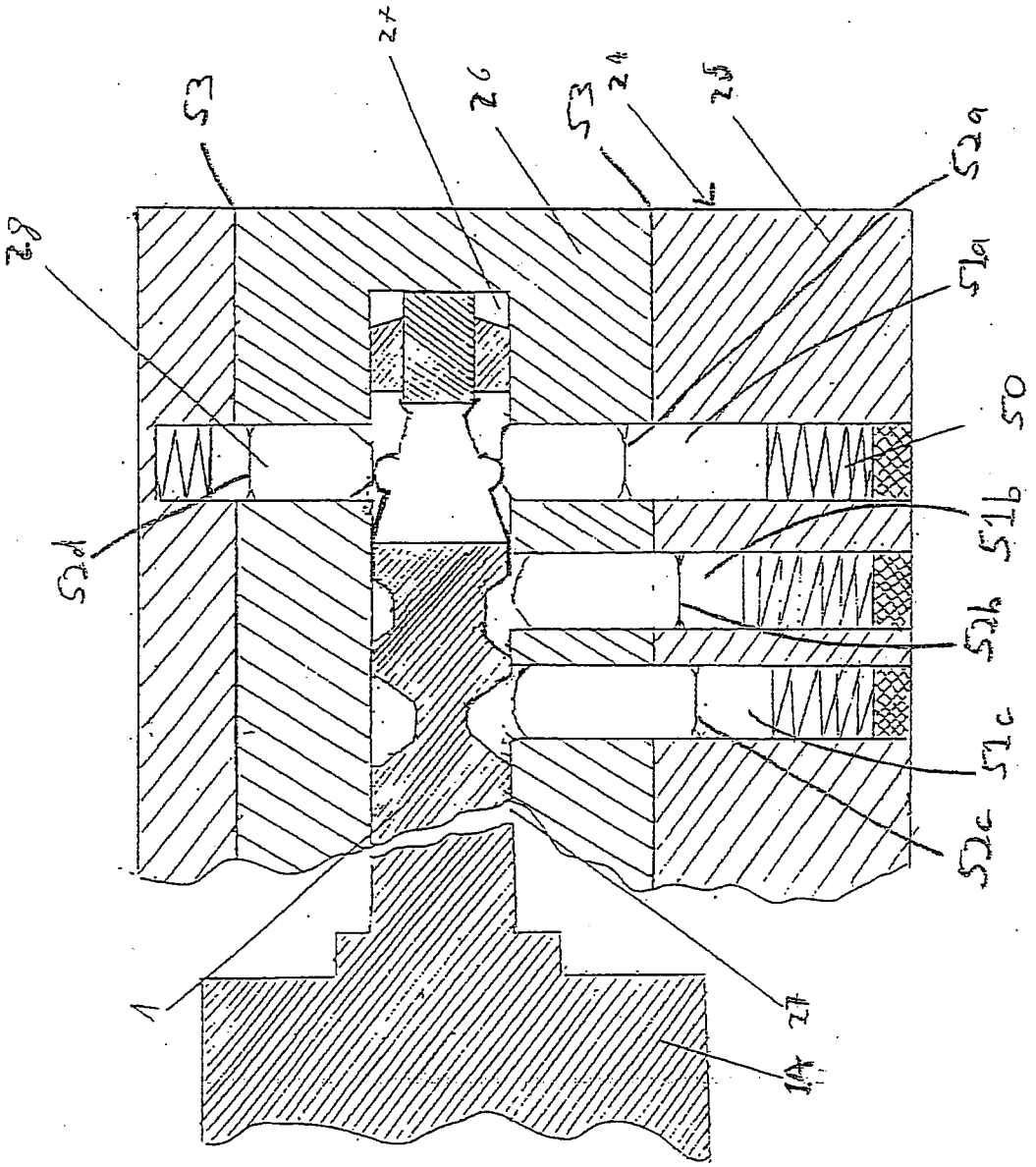

FIG. 10

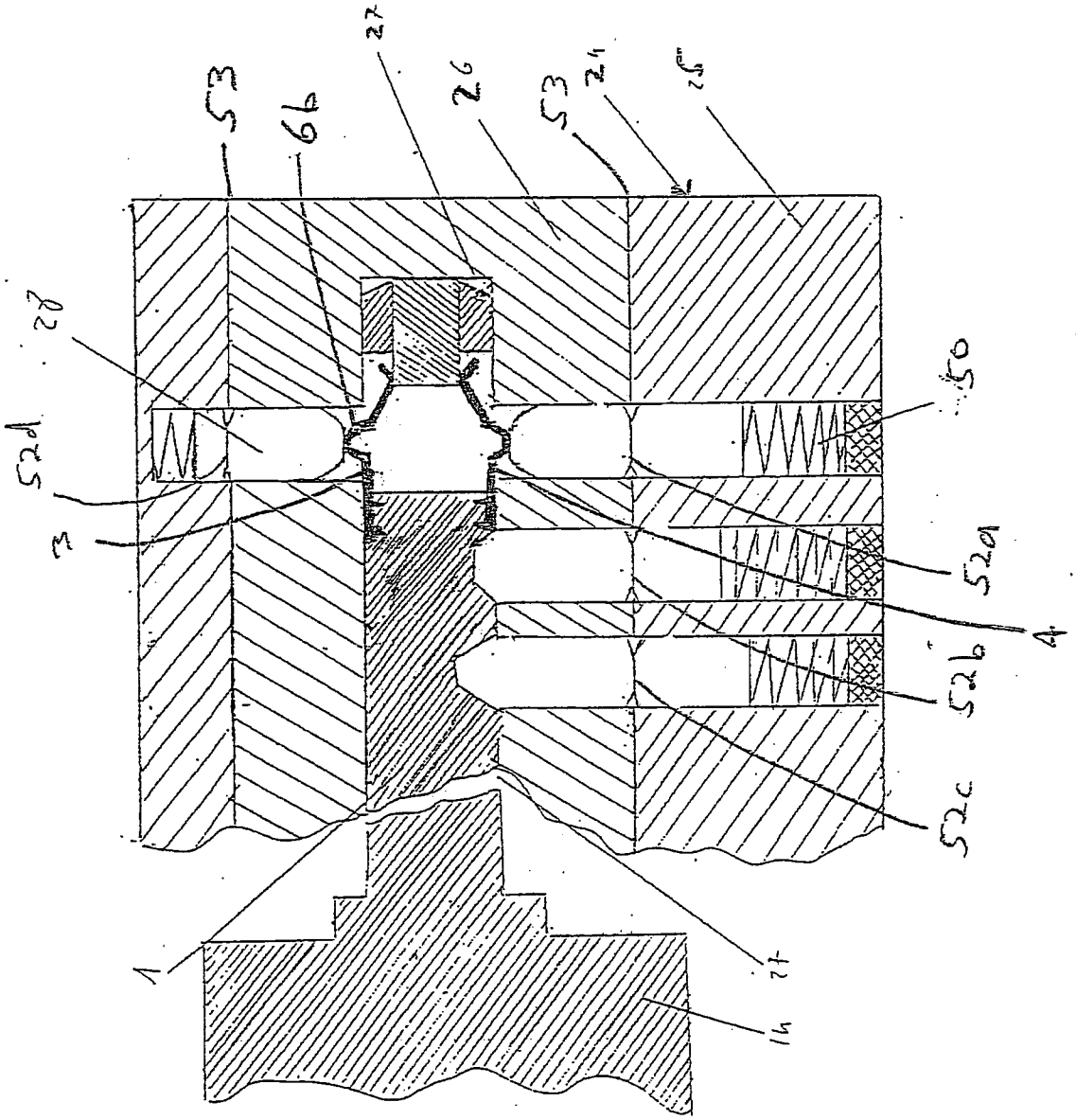

FIG. 11

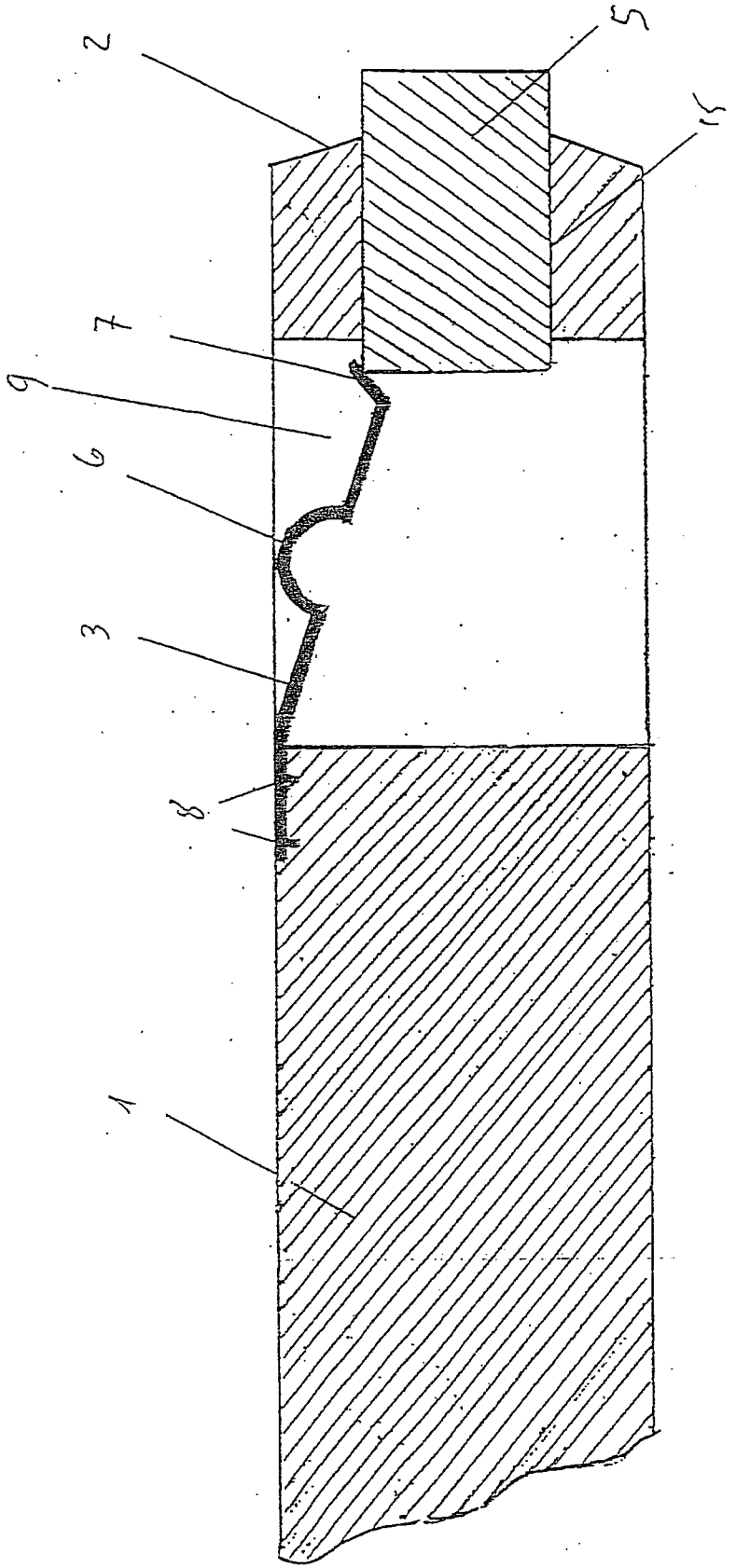

FIG 12

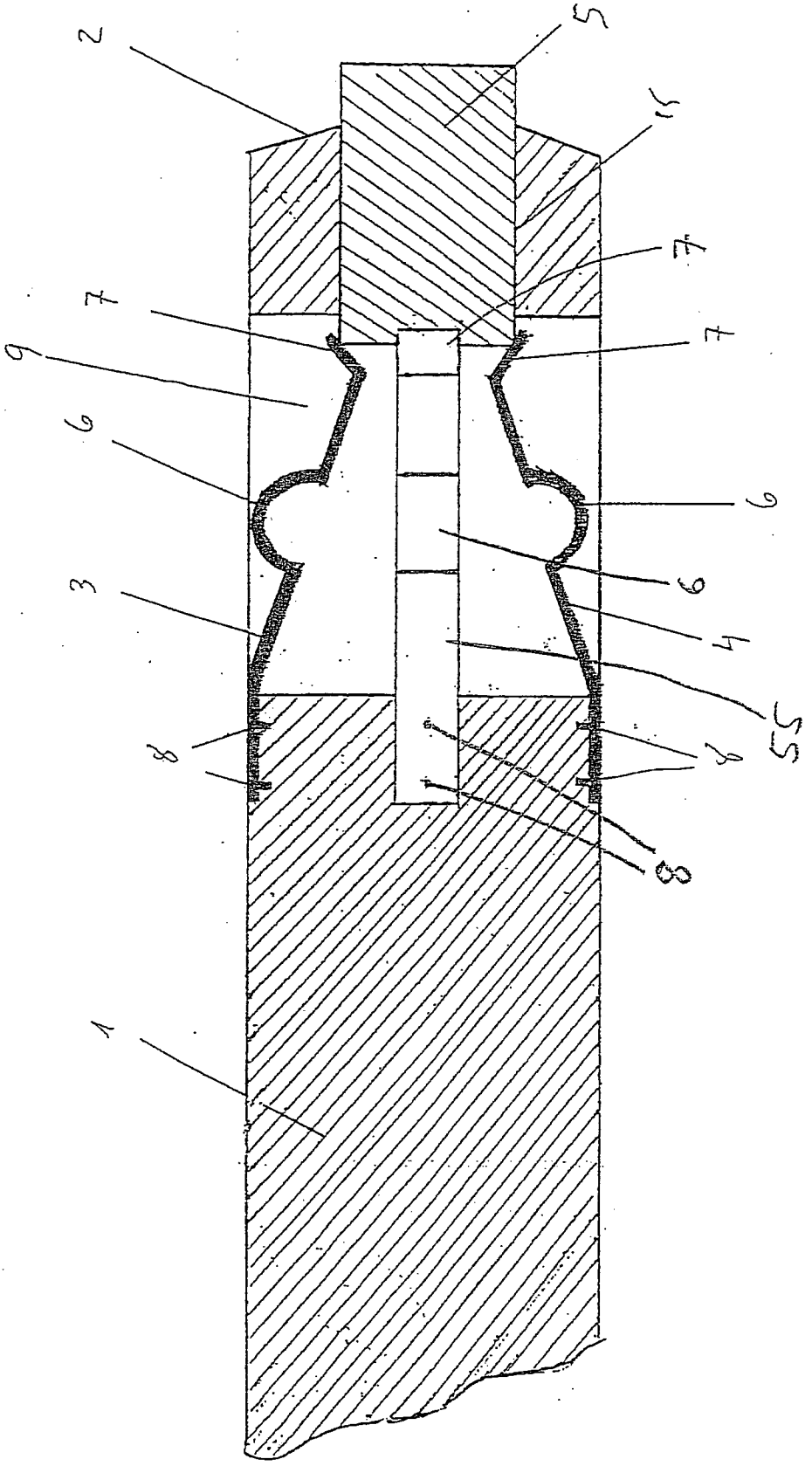

FIG. 13

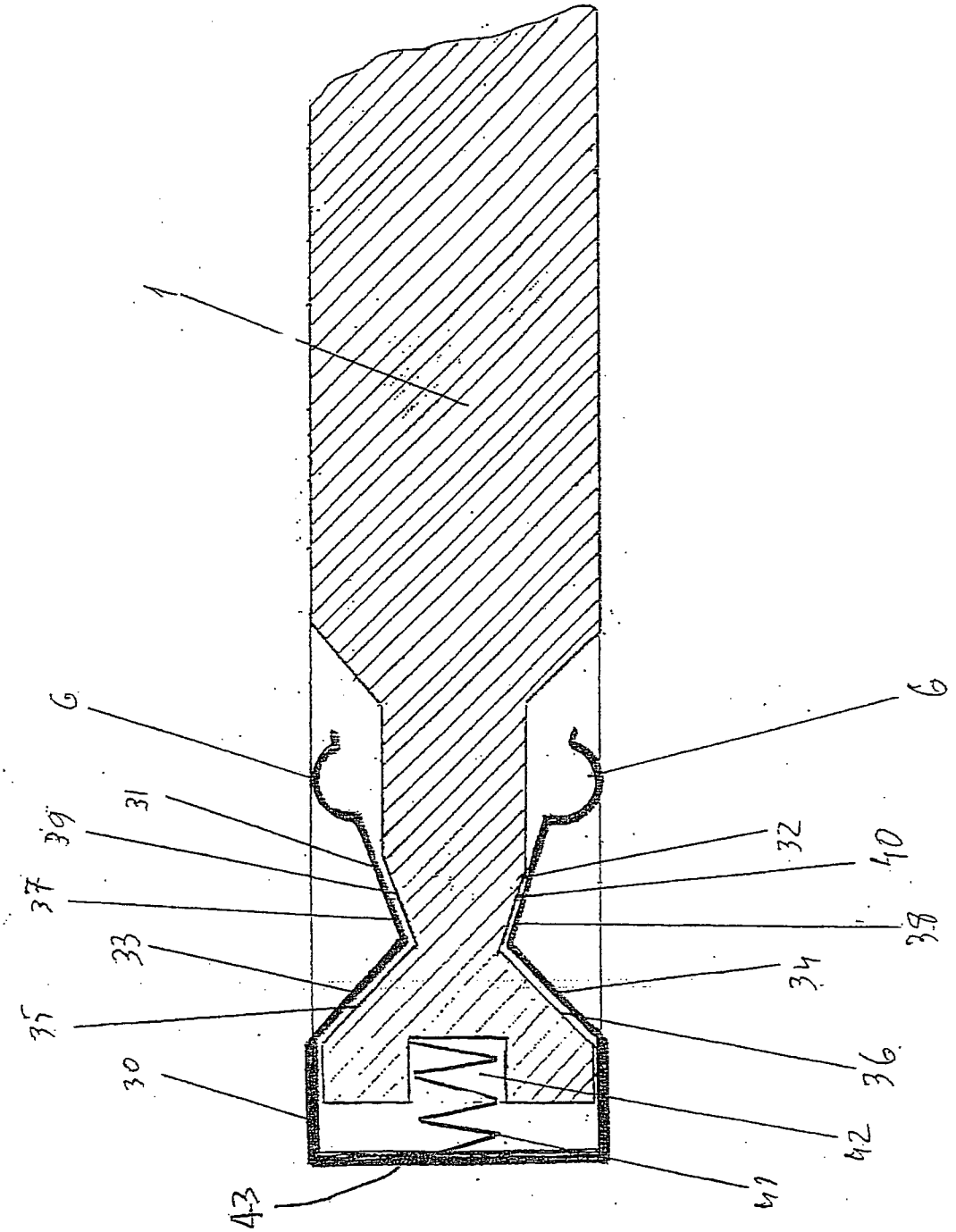

FIG 14

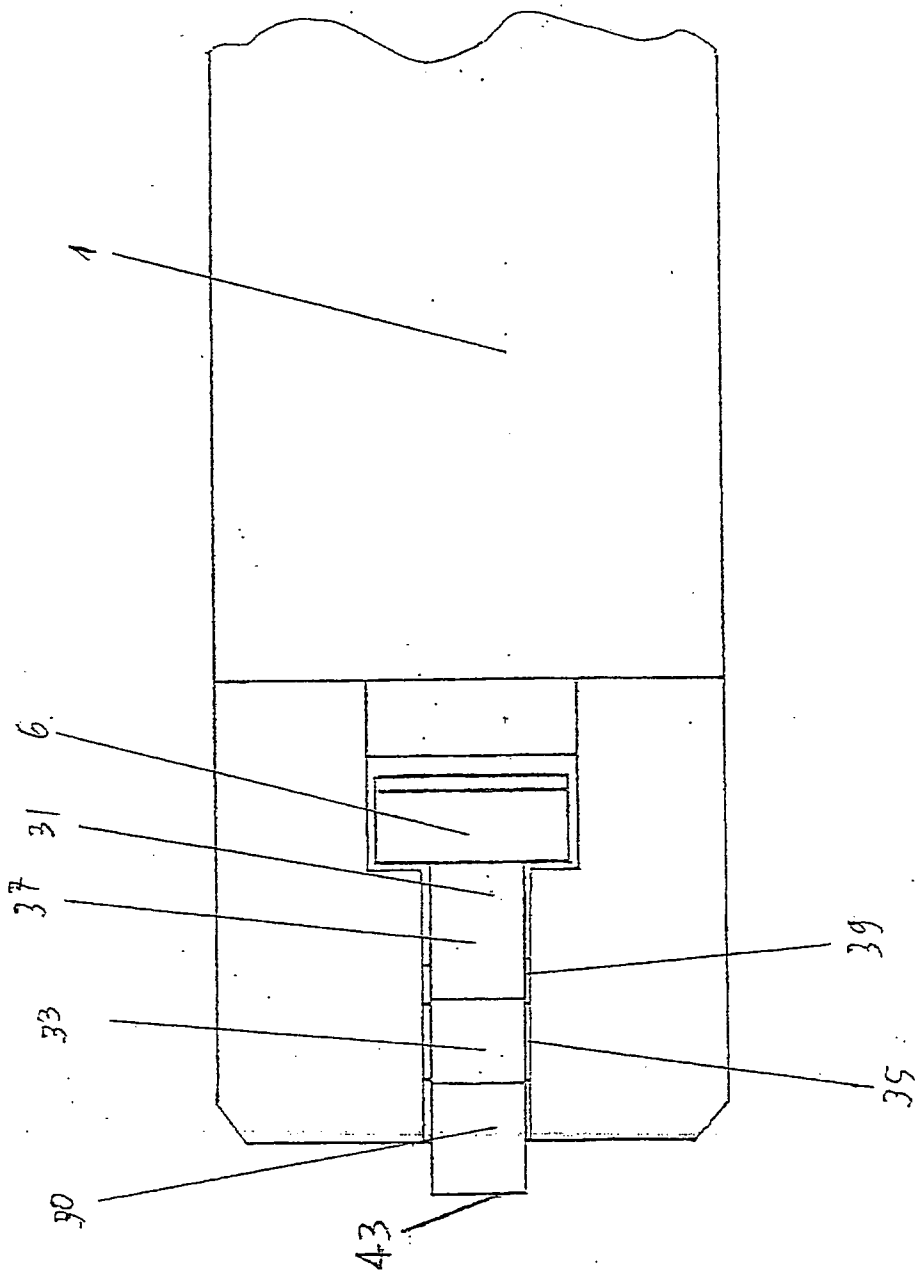

FIG. 15

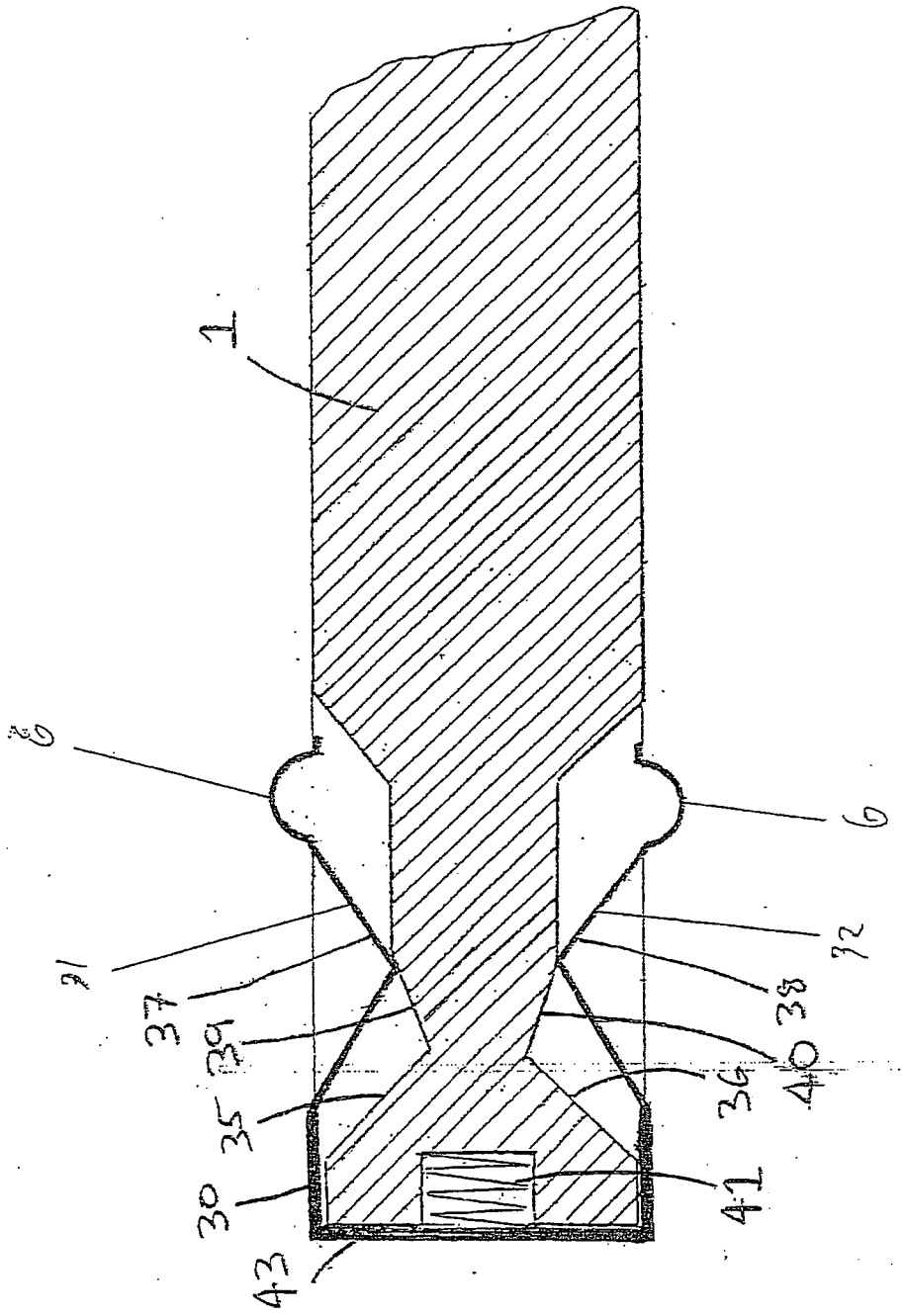

FIG. 16