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DEVICE FOR FIREARMS AND FIREARM

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The present invention relates to a device for firearms for detecting and transferring an optical signal which is correlated to a state in a space, according to the preamble of Claim 1, and a firearm according to the preamble of Claim 18.

20 On firearms, particularly on semiautomatic and automatic firearms such as cannons, sensors are used at multiple points for the purpose of detecting signals during the use of the firearms, in order to monitor the firearms, particularly during firing. Specifically, the sensors detect signals in this case which are correlated to states in spaces to be monitored. Transmission units are generally
25 connected to the sensors in order to transmit the signals detected. The transmitted signals are used for various purposes; they may merely be used for the purpose of giving the operating personnel information about the state detected, but they may also be used in a control loop or regulating circuit in order to, for example, check a sequence of functions in the framework of firing
30 shots.

States to be detected may be positions of mechanical weapon components, which are present in the spaces to be monitored only temporarily and/or in various components of their mass, for example. Examples of these are slide
35 positions, breech positions, clutch positions, trigger positions, and drum

positions, but filling states of cartridge chambers, for example, may also be monitored in this way.

5 Examples of the utilization of the signals, which describe the states cited or other states, are the direct change of a movement state, i.e., the initialization, change, or termination of a movement of a weapon part, or the construction of a control loop or a regulating circuit. Firearms like cannons may, for example, have a gas drive as an intrinsic drive and also have an electric drive for the ammunition supply, the gas drive and electric drive operating independently of one another
10 and therefore their controls having to be linked to one another by a regulating circuit for flawless functioning of the firearm.

Mechanical, inductive, capacitive, or magnetic devices are typically used on firearms as sensors for the purposes cited above, but these are not suitable for
15 modern automatic weapons having a higher cadence in particular. In such firearms, high shock-like stresses and alternating stresses of high frequency arise, which leads to sensitive parts of typical construction, like the devices just cited, not functioning properly and/or having only a brief service life. In this case, the devices positioned directly on the weapon barrel are subjected to
20 particularly high wear.

Firearms which have sensor devices having fiber-optic systems are known from U.S. Patent 5,425,299 and U.S. Patent 5,735,070. These have the disadvantage that the sensitive regions of the fiber-optic systems are not shielded, so that
25 they do not operate or do not operate reliably in the event of even slight contamination, as typically occurs in weapons.

It is therefore the object of the present invention,

- to provide a device of the type initially cited, which does not have the
30 disadvantages cited above and using which a long service life may be achieved with precise function even for weapons having a higher cadence; and
- to suggest an improved firearm of the type initially cited.

35 This object is achieved according to the present invention

- for the device by the characterizing features of Claim 1; and
- for the firearm by the characterizing features of Claim 19.

Preferred refinements of the present invention are defined by the respective
5 dependent Claims 2 to 17 and 19 to 30.

Using the present invention, it is possible to make highly sensitive fine
mechanisms suitable for an object which is subjected to high and strongly
oscillating mechanical stresses, specifically for a firearm, even one having a high
10 cadence.

Therefore, the device according to the present invention and/or the firearm
equipped therewith has, instead of typical mechanical, inductive, capacitive,
magnetic, or electrical devices, a fiber-optic system, which has been shown to be
15 resistant to shock stresses and vibrations. The resistance to shocks and
vibrations is achieved in that, among other things, the fibers joined into bundles
for the fiber-optic system are used in a number of, for example, up to 100 or up
to 200 fibers, each fiber having a diameter of 12 μm , for example.

20 The states to be detected in the space to be monitored are typically scannable
states. The scannable states to be detected are to be understood as both the
position of a material element and a pressure in a pressure vessel, a material
element able to be scanned directly and a pressure in a pressure vessel able to
be scanned through a displaceable piston.

25 Fiber-optic systems only operate correctly if they are not impaired. In this case,
impairments to be feared are less mechanical damage than contaminations.
However, there is frequently a significant danger of contamination in firearms;
the fiber-optic systems may be affected by material of many types, such as dust,
30 soot, liquids such as lubricants, for example, graphite grease, and vapors, very
generally contaminations in solid and liquid form. In order to avoid malfunction
as a consequence of such impairments, the fiber-optic systems are shielded in
that at least their sensor region is protected by a shielding device, which may be
either a wall positioned in a suitable way or a chamber.

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In order to avoid misunderstandings, it is to be expressly noted that such a chamber is not the space to be monitored, in which a state may be determined by the novel device, and is also not the pressure vessel cited above, but rather is a region shielded from contamination, in which at least the sensor region of the fiber-optic system is positioned.

An indicator, which senses the state to be detected directly or indirectly and adjusts its position as a function of the state, indicates the state to be detected in the space to be monitored. The position of the indicator is registered by the sensor region of the fiber-optic system.

In principle, two optical methods are considered for detecting the position of the indicator. In the first method, the particular position of the indicator is detected directly, in that the sensor region of the fiber-optic system forms a light barrier into which the indicator projects in certain positions; the fiber-optic system generates a signal when the indicator assumes a special position; the indicator may either be implemented compactly in this case and interrupt the otherwise detectable light beam in the special position, or the indicator may have an opening through which the otherwise interrupted light beam passes. A mirror effect is used in the second method for detecting the position of the indicator.

There are various variants for the implementation, arrangement, and mode of operation of the indicator, of which the preferable ones are described in the following.

The position of the indicator is determined by a feeler, which in turn senses the state in the space to be monitored, generally in that it scans it mechanically. The indicator and the feeler may form different components which move at least partially in solidarity, or they may be in one piece. The feeler thus scans the state to be detected in the space to be monitored, through which its position and therefore the position of the indicator are determined. The sensor region of the fiber-optic system registers, as already described, the position of the indicator.

The chamber in which at least the sensor region of the fiber-optic system is positioned is not a completely closed capsule, but rather it has an inlet and/or opening, through which the indicator projects into the chamber.

5 For a reliable mode of operation of the device it is imperative that this inlet and/or opening is implemented in a suitable way. Firstly, the inside of the chamber is to be prevented from becoming so unclean that the sensor region of the fiber-optic system no longer operates flawlessly; the inlet must therefore be provided with a sealing arrangement. Secondly, return of the feeler, which
10 generally occurs under the force of a return spring, must occur without friction or at least with as little friction as possible; the sealing arrangement must therefore be implemented so that the return of the feeler is not hindered by frictional forces.

15 In order to use the signals detected by the fiber-optic system, which describe the state in the space to be monitored, it is advantageous to convert these optical signals into electrical signals, for which an optical/electrical converter device may be provided. This converter device and possibly the devices connected thereto may be more sensitive to shock and vibration than the fiber-optic system, but
20 this may be accepted in this case, because these devices may be positioned without problems outside those regions of the firearm in which the especially high shock and vibration stresses occur.

The signals sensed and transferred according to the description above, which are
25 a function of the position of the feeler and/or of the indicator and therefore a function of the state to be detected in the space to be monitored, are generally a certain type of "digital" and/or qualitative signal; for example, such signals indicate whether a component of the firearm occupies a specific setting or not or whether a specific cartridge chamber is occupied by a cartridge or not. However,
30 in certain cases it is advantageous to also detect the state in the space to be monitored quantitatively. In an advantageous refinement of the device according to the present invention, the fiber-optic system is laid out for the purpose of being able to also detect and transfer signals which contain more precise information, like quantitative signals.

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For example, at least one further feeler and/or at least one further indicator may be provided, which work together with a further sensor region of the fiber-optic system. Such an arrangement may be used in various ways. Firstly, if the space to be monitored is a cartridge chamber, for example, it may be detected not only whether this cartridge chamber is occupied by cartridge or not, but the length and therefore the type of the cartridge located in the cartridge chamber may also be detected qualitatively. Secondly, the arrangement may also be used as a double safety.

The level of a pressure in a pressure vessel may also be detected quantitatively in that the position of a corresponding indicator is detected by one or more sensor regions.

More precise information about the state to be detected in the space to be monitored may also be obtained if the indicator has markings, for example barcodes, in various adjoining regions, of which one or another marking may be read by the fiber-optic system, depending on the position of the indicator.

In the following, the present invention is described in detail on the basis of examples and with reference to the drawing, which form an integral part of the present disclosure.

Figure 1A shows a first exemplary embodiment of a device according to the present invention, in a greatly simplified, schematic illustration;

Figure 1B shows a second exemplary embodiment of a device according to the present invention, in a greatly simplified, schematic illustration;

Figure 1C shows a third exemplary embodiment of a device according to the present invention, in a greatly simplified, schematic illustration;

Figure 1D shows a fourth exemplary embodiment of a device according to the present invention, in a greatly simplified, schematic illustration;

Figure 1E shows a further exemplary embodiment of a device according to the present invention, which works together with a further device according to the present invention, in a greatly simplified, schematic illustration;

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Figure 2 shows a part of a firearm which has multiple devices according to the present invention:

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Figure 2A shows the firearm illustrated in Figure 1 in a section along the line A-A of Figure 2, greatly simplified, to illustrate a first of the devices of the firearm illustrated in Figure 2;

Figure 2AA shows a detail of Figure 2A;

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Figure 2B shows the firearm illustrated in Figure 1 in a section along the line B-B of Figure 2, greatly simplified, to illustrate a second of the devices of the firearm illustrated in Figure 2;

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Figure 2C shows the firearm illustrated in Figure 1 in a section along the line C-C of Figure 2, greatly simplified, to illustrate a third of the devices of the firearm illustrated in Figure 2;

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Figure 2D shows the firearm illustrated in Figure 1 in a section along the line D-D of Figure 2, greatly simplified, to illustrate a fourth of the devices of the firearm illustrated in Figure 2;

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Figure 2E shows the firearm illustrated in Figure 1 in a section along the line E-E of Figure 2, greatly simplified, to illustrate a fifth of the devices of the firearm illustrated in Figure 2;

Figure 2F shows the firearm illustrated in Figure 1 in a section along the line F-F of Figure 2, greatly simplified, to illustrate a sixth of the devices of the firearm illustrated in Figure 2;

Figure 3 shows a schematic of a circuit in which the linkages of the devices according to the present invention as shown in Figures 2A to 2F are illustrated.

5 Figures 1A to 1E are used for explaining the principle of the present invention. Figure 1A shows a space 10 to be monitored, which is located on a weapon (not shown) in a region S subject to shock and vibration. A cam wheel 12, having four cams 12.1 to 12.4, which is rotated around an axis 14, shown in Figure 1 as point 14, is positioned in the space 10. In the present case, the angular position
10 of the cam wheel 12 is considered a state to be detected in the space 10. A mechanical feeler 16 has a feeler part 16.1, which, in any of its possible positions, is located in the space 10 and touches the cam wheel 12 on its contour. The mechanical feeler 16 is pre-tensioned on the cam wheel 12 using a spring device 18. A second feeler part 16.2 of the mechanical feeler 16 projects,
15 at least in the uppermost position which the mechanical feeler 16 may assume, through an inlet 20.1 into a chamber 20, which forms a shielding device for a fiber-optic system 24. The second feeler part 16.2 forms an indicator 17.

A sealing device 20.2 is used for the purpose of keeping gaseous, liquid, and
20 solid material, which could impair the functioning of devices positioned in the chamber 20, out of the chamber 20. Since the volumes are generally small, there is usually no problem caused by condensation. The sealing device 20.2 achieves a tightly sealed but simultaneously frictionless or at least very low friction mutual contact of two surfaces, generally shaped like cylinder jackets,
25 which move relative to another.

Preferably, one of these surfaces is provided with a sealing arrangement and the other of these surfaces is provided with the best surface polish. One surface and/or the sealing arrangement 20.2 may have sealing compounds, O-rings, or
30 Teflon sealing rings; the other surface may, for example, be a finely polished metal surface.

The indicator 17 may have a diameter of approximately 4 mm to approximately 15 mm, at least in the region which is pushed through passage 20.1. The radial
35 thickness of a ring, made of Teflon, for example, which is suitable for a sealing

compound, may be approximately 0.5 mm and its axial width may be approximately 1 mm. The polished surface may have the quality 3M when polished. These numbers are only examples and are in no way understood to be as restrictive.

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In its position illustrated in Figure 1A, the mechanical feeler 16 projects far enough into the chamber 20 that its second feeler part 16.2 and/or the indicator 17 interrupts a light beam 22 of a light barrier 24.1, 24.2, this light barrier forming the sensor region of the fiber-optic system 24. Like the space 10, the
10 chamber 20 is also in the region A of the weapon subject to shock and vibration. The fiber-optic system 24 is implemented in such a way that it provides an optical signal which is directly a function of the position of the indicator 17 and/or the feeler 16 and indirectly a function of the angular position of the cam wheel 12, and is therefore correlated to the mechanical state in the space 10 to be
15 monitored. As shown in Figure 1A, the feeler 16 is in its uppermost position when the cam wheel 12 assumes a setting in which two diametrically opposed cams, e.g., the cams 12.1 and 12.3, are on a vertical connection line through the point 14, and the other two cams 12.2 and 12.4 are on a horizontal connection line through the point 14. A conductor arrangement 24.3 of the fiber-optic
20 system 24 leads out of the chamber 20 and is coupled to an optical/electronic converter 26, which is used for the purpose of converting the optical signal, detected by the sensor region and/or the light barrier 24.1, 24.2 of the fiber-optic system 24 and transmitted by the conductor region of the fiber-optic system 24, into an electrical signal. The electrical signal is supplied via a line 27
25 to a computer unit 28, which is implemented for the purpose of using this electrical signal.

The optical/electrical converter 26 and the computer unit 28 are in a region P of the weapon and/or a weapon system which the weapon is a part of, which is
30 subjected to shock or vibration less than the region A or not at all, or in which it is at least possible to provide damping devices (not shown) in order to reduce the effects of shocks and vibrations on the devices described individually and possibly on further devices.

Figure 1B shows another exemplary embodiment of the device according to the present invention, in which the sensor region of the fiber-optic system 24 is also formed by a light barrier 24.1, 24.2. The indicator 17 is implemented and positioned in such a way that in most of its settings it interrupts the light beam 22 of the light barrier 24.1, 24.2 of the fiber-optic system 24. The indicator 17 has an opening 17.1; in a special position, which corresponds to a special state in the space 10 to be monitored, the indicator 17 is in a setting in which its opening 17.1 opens the path to the light beam 22 of the light barrier 24.1, 24.2 of the fiber-optic system 24.

A further exemplary embodiment of the novel device is illustrated in Figure 1C. The light barrier 24.1, 24.2 is implemented here in such a way that its two elements are not position aligned, but rather transversely and/or diagonally to one another. The indicator 17 has two pin-shaped indicator parts 17.2, each of which has an end region which acts as a partial reflection surface of a reflection surface 17.3. In a special position of the two-part indicator 17, which corresponds to a special state in the space 10 to be monitored, the reflection surfaces 17.3 work together in such a way that the light beam 22 of the light barrier 24.1, 24.2 is deflected from one element 24.1 of the light barrier to the other element 24.2 of the light barrier, as indicated by the dotted line.

Figure 1D shows yet a further exemplary embodiment of the novel device, in which the indicator 17 is implemented in such a way that it has multiple indicator regions 17.10, 17.11, 17.12. Each of the indicator regions 17.10, 17.11, 17.12 has a marking which is recognizable by the sensor region 24.1 of the fiber-optic system 24. In this way, the state in the space 10 to be monitored may be detected in a quantified way, either in that the markings are different and may be recognized and/or read by the sensor region of the fiber-optic system 24, or in that the markings are counted. Furthermore, it is possible, through coupling to a time measurement, to determine the speed of a change of the state in the space 10 to be monitored, in that the number of the markings recognized per unit of time is established. Instead of detectable and/or readable markings, the indicator 17 may also have multiple openings, which, in a suitable position, allow the passage of an otherwise interrupted light beam of a light barrier.

Figure 1E shows a further exemplary embodiment of a device according to the present invention, which has the feeler 16 and/or indicator 17 and the fiber-optic system 24 with the sensor region having a light barrier 24.1, 24.2. In addition, a second feeler 116 and/or indicator 117 and a second light barrier 124.1, 124.2 are provided as a second sensor region. The space 10 to be monitored is a cartridge chamber, and the state to be monitored is the presence of a cartridge 100. If a section of a cartridge was located neither in the region of the first feeler 16 and/or indicator 17 nor in the region of second feeler 116 and/or indicator 117 in the cartridge chamber, neither of the light barriers 24.1, 24.2 and/or 124.1, 124.2 would detect the associated indicator 17 and/or 117. If cartridge 100 is completely in the cartridge chamber, as shown in Figure 1E, the light barrier 24.1, 24.2 detects both the indicator 17 and the indicator 117.

A section of an automatic firearm 1 having a weapon barrel 2 is illustrated in Figure 2. The firearm 1 has multiple devices according to the present invention, each of which is used for the purpose of monitoring a specific space and detecting the state existing there. The points at which the devices are positioned are indicated by section lines A-A, B-B, C-C, D-D, E-E, and F-F.

Figure 2A shows the section A-A of Figure 2, having one of the devices according to the present invention, in which the state to be detected is the locking and/or unlocking of the weapon barrel 2. Figure 2AA shows the section IIA-IIA of Figure 2A. In the locked state of the weapon barrel 2, two locking elements 30 are in the position shown in Figure 2A, from which they are displaced to the left in the unlocked state. The indicator 17 is implemented here in two parts and has two pin-like indicator parts 17.2, which are movably positioned in an opening 32 of a body 34. The ends of indicator parts 17.2 projecting out of the opening 32 engage in grooves 31 of the locking element 30 as long as the locking elements 30 are in the locked setting. If they are not locked, the locking elements are displaced to the left from their position shown in Figure 2A, which has the consequence that the indicator parts 17.2 are displaced in the opening 32, first toward the inside of the opening 32 and, upon further displacement of the locking elements 30, out of the opening 32 under the force of springs 36. Correct locking only exists if the locking elements 30 and therefore the indicator parts 17.2 are located in the position illustrated in Figure 2A.

In the present exemplary embodiment shown in Figure 2A, the position of the indicator 17 and/or of the indicator parts 17.2 is not detected directly by the sensor region 24.1, 24.2 of the fiber-optic system 24, but rather a mirrored surface and/or reflection surface 17.3 is used, with the aid of which the sensor regions 24.1, 24.2 of the fiber-optic system 24 recognize that the locking exists. The mirrored surface and/or reflection surface 17.3 is continuous and flat and it includes, as illustrated in Figure 2AA, two partial reflection surfaces, movable in relation to one another, which are produced on the diametrically opposite inner ends of the indicator parts 17.1. These inner ends of the indicator parts 17.1 are not circular in cross-section, but rather have the shape of only a quarter circle, and they are positioned complementarily, so that they may be displaced in the same length region of the recess 32 upon locking; in this case, one semicircle of the cross-sectional area of the recess 32 is occupied by both of the inner ends of the indicator parts 17.1. The remaining semicircle of the cross-sectional area of the recess 32 remains empty and forms a space for the beam 22 of the light barrier 24.1, 24.2, whose two light barrier units are positioned diagonally in this case. Only in the complete and/or secure locking state, i.e., when the inner ends of the indicator parts 17.1 form the continuous reflection surface 17.2, may the beam of the light barrier 22 be reflected and the signal corresponding to the locked state be generated by the fiber-optic system 24.

The locked state is therefore double-checked. The fiber-optic system 24 is continued in the conductor arrangement 24.3. The mode of operation of the device shown in Figure 2A inside a weapon controller may be seen in Figure 3, in which it is indicated with A.

It is to be noted that the principle described above of the reflection of the beam of the light barrier may also be used in another way, for example, for simple detection and/or checking of the state. It is not necessary for the reflection surface to be composed of two partial surfaces, it may have one single surface or more than two partial surfaces, is flat, and it also does not necessarily have to be continuous. Furthermore, the two elements of the light barrier may also be positioned at an angle other than 90°, i.e., other than precisely diagonally. It is only essential that upon the occurrence of a specific state, or possibly multiple

states, in the space to be monitored, the reflection surface is positioned relative to the light barrier in such a way that a reflection occurs or an existing reflection is prevented, so that a corresponding signal is generated.

5 Figure 2B shows the section B-B of Figure 2, having one of the devices according to the present invention, in which the state to be monitored is the setting of a slide 40. The slide 40 acts as a clock for multiple cycles and thus forms, in a certain way, a pacemaker for the firearm 1. Figure 2B shows the slide 40 in its forward position. A slide part 42 is in contact with a scanning pin, which forms
10 the feeler 16. Upon a rotation of a drum 3 of the firearm 1, the slide 40 moves in the direction of the lengthwise axis of the weapon barrel 2. At the same time, the slide part 42 displaces the scanning pin and/or feeler 16. The feeler part on which the indicator 17 is implemented projects through the opening 20.1, which is provided with a sealing device 20.2, into the chamber 20. The light barrier
15 24.1, 24.2 forming the sensor region of the fiber-optic system 24 and the adjoining section of the conductor arrangement 24.3 of the fiber-optic system 24 are positioned in the chamber 20. The mode of operation of the device shown in Figure 2B within a weapon controller may be seen in Figure 3, in which it is indicated with B.

20 Figure 2C shows the section C-C of Figure 2 having a third arrangement of one of the devices according to the present invention. In this case, the occupation by a cartridge of a cartridge chamber 50 of the drum 3 is understood as the state to be monitored. In the arrangement illustrated in Figure 2C, the cartridge
25 chamber 50 is in the firing position, and a position is shown in which this cartridge chamber 50 is empty. A cartridge detection pin, which forms the feeler 16, scans whether the cartridge chamber 50 is occupied by a cartridge. The feeler part 16 projecting into the cartridge chamber 50 - empty as shown in Figure 2C - would be pushed radially out of the drum 3 by a cartridge, i.e.,
30 downward in Figure 2C. The feeler part diametrically opposite the feeler part 16.1 forms the indicator 17 and projects into the chamber 20. In this case as well, the light barrier 24.1, 24.2 forming the sensor region of the fiber-optic system 24 and the adjoining section of the conductor arrangement 24.3 of the fiber-optic system 24 are positioned in the chamber 20. The mode of operation of

the device shown in Figure 2C within a weapon controller may be seen in Figure 3, in which it is indicated with C.

Figure 2D shows the section D-D of Figure 2, having a fourth arrangement of one of the devices according to the present invention, using a redundant arrangement. In this case, the setting of a firing pin 60 is understood as the state to be monitored. In this arrangement, the position of the firing pin 60 itself is not established by the sensor region, but rather the position of a signal pin, the signal pin playing the role of the indicator 17 and being positioned so that its axis is parallel to the firing pin 60. The firing pin 60 has an oblong hole 61, and its movement may be coupled in the axial direction for translational movement with the signal pin and/or indicator 17, with the aid of an oblong hole 61 and coupling clips 62, 64.

The signal pin and/or indicator 17 is implemented and positioned here so that it works together with the first light barrier 24.1, 24.2 and/or the sensor region and with a second light barrier 124.1, 124.2 and/or a further sensor region of the fiber-optic system 24. For this purpose, the signal pin and/or indicator 17 has two openings 17.1, 17.101, running transversely to its lengthwise direction. If the signal pin and/or indicator 17 is positioned as shown in Figure 2D, the beam 22 of the light barrier 24.1, 24.2 passes through the opening 17.1 and is therefore not interrupted. The beam 122 of the light barrier 124.1, 124.2 is simultaneously interrupted by the signal pin and/or indicator 17, since the second opening 17.1 is not in the path of this beam 122.

The circuit is such that the signal of the light barrier 24.1, 24.2 corresponds to a position of the signal pin and/or indicator 17 which indicates whether the firing pin is secured or unsecured, the interrupted beam 122 of the light barrier 124.1, 124.2 corresponding to a position of the signal pin and/or indicator 17 which indicates that the firing pin 60 is secured. Conversely, an interrupted light beam 22 of the light barrier 24.1, 24.2 and an uninterrupted light beam 122 of the light barrier 124.1, 124.2 indicates that the firing pin 60 is unsecured.

The state to be determined in the space 10 to be monitored is thus detected doubly. It is obvious that the circuit may also be reversed. The device shown in

Figure 2D and/or its mode of operation may be seen in Figure 3, in which it is indicated using D1 and D2. It is also to be noted that using a different circuit, but the same indicators and the same sensor region of the fiber-optic system, a simultaneously acting double securing arrangement may also be implemented instead of a redundant arrangement.

Figure 2E shows the section E-E of Figure 2 having a fifth arrangement of the device according to the present invention. In this case, the setting of a gear wheel clutch 70 is understood as the state to be monitored. In this case as well, there is double detection of the state, in that the clutch setting ON and the clutch setting OFF are monitored. A movable forked part 72 indicates the setting of the clutch 70 through its position. The pin forms the feeler 16, on one end of which the indicator 17 is implemented. The position of the pin 72 and/or of the indicator 17 is detected by two light barriers, similarly as described with reference to Figure 2D. Furthermore, Figure 2E shows an additional monitoring device for the trigger, which is not implemented using a fiber-optic system, but rather using a solenoid. The mode of operation of the device shown in Figure 2E inside a weapon controller may be seen in Figure 3, in which the device implemented using the fiber-optic system 24 is indicated using E1 and E2, while the monitoring device implemented using the solenoid is indicated using G.

In section F-F, Figure 2F shows a sixth arrangement of one of the devices according to the present invention. In this case, delivery of ammunition into a specific region is understood as the state to be monitored. The arrangement is essentially always identical: a pin, one end of which forms the feeler 16 and the other end of which forms the indicator 17, is positioned movably. Delivered ammunition displaces the pin in Figure 2F to the right. The mode of operation of the device shown in Figure 2F within a weapon controller may be seen in Figure 3, in which it is indicated using F.

Finally, Figure 3 schematically shows how the devices according to the present invention as shown in Figures 2A to 2F are coupled to one another. The use of the device according to the present invention implemented in this way, which is especially advantageous, is used, as briefly mentioned above, for the purpose of

detecting, controlling, or regulating the sequence of various procedures in the firearm.

Patent Claims

What is claimed is:

- 5 1. A device for firearms (1), for detecting a state in space (10) and for transmitting a signal correlated to the state,
 - having a sensor region (24.1, 24.2) for detecting the state and having a conductor arrangement (24.3), connected to the sensor region (24.1, 24.2), for transmitting the signal, the sensor region
10 (24.1, 24.2) and the conductor arrangement (24.3) being formed by a fiber-optic system (24), and
 - having a movable indicator (17), whose position corresponds to the state to be detected in the space to be monitored (10) and which is detectable by the sensor region (24.1, 24.2),
15 characterized in that
 - the sensor region (24.1, 24.2) of the fiber-optic system (24) is shielded by a shielding device (20).
- 20 2. The device according to Claim 1, characterized in that the shielding device is a chamber (20) in which the sensor region (24.1, 24.2) is received.
- 25 3. The device according to one of Claims 1 to 2, characterized in that the state in the space to be monitored (10) may be sensed indirectly by the indicator (17), the state in the space to be monitored (10) able to be sensed by a feeler (16), to which the movement of indicator (17) may be coupled at least part of the time, for example.
- 30 4. The device according to one of Claims 1 to 2, characterized in that the state in the space to be monitored (10) may be sensed directly by a part of the indicator (17) which is not protected by the shielding (20).
5. The device according to one of Claims 1 to 4,

characterized in that a wall of the shielding (20) has an opening (20.1), through which a part of the indicator (17) projects movably into the sensor region (24.1, 24.2) protected by the shielding (20).

5 6. The device according to Claim 5,
characterized in that the opening (20.1) and the part of the indicator (17)
projecting movably through the opening (20.1) each form a sealing
surface, these sealing surfaces lying diametrically opposite one another
and forming a sealing device (20.2) in the opening (20.1).

10 7. The device according to Claim 6,
characterized in that one of the sealing surfaces is implemented as a
smooth surface and the other sealing surface has a sealing compound,
preferably a sealing ring, the smooth surface and the sealing compound
15 being intended for the purpose of executing a low-friction relative
movement during the movement of indicator (17) through the opening.

8. The device according to one of Claims 1 to 7,
characterized in that

- 20 - the indicator (17) projects through the shielding (20) into the
sensor region (24.1, 24.2) of the fiber-optic system (24) protected
by the shielding (20), and
- the indicator (17) and the sensor region (24.1, 24.2) of the fiber-
optic system (24) are implemented and positioned in such a way
25 that the position of the indicator (17) is directly detectable by the
sensor region (24.1, 24.2).

9. The device according to one of Claims 1 to 7,
characterized in that

- 30 - the indicator (17) projects through the shielding (20) into the
sensor region (24.1, 24.2) of the fiber-optic system (24) protected
by the shielding (20), and
- the sensor region (24.1) of the fiber-optic system (24) is
implemented and positioned in such a way that the position of the

indicator (17) is indirectly detectable with the aid of an optical unit,
in particular a reflection unit (17.2).

10. The device according to Claim 9,
5 characterized in that the reflection unit has at least two reflection surfaces (17.2), which are formed by surfaces of indicator parts (17.1) of the indicator (17), implemented in multiple parts, which may be caused to work together.
- 10 11. The device according to one of Claims 1 to 10,
characterized in that the sensor region of the fiber-optic system (24) has a light barrier (24.1, 24.2) having two light barrier elements.
12. The device according to Claim 11,
15 characterized in that a region of the indicator (17), which is movable between the light barrier elements and completely screens light, interrupts a light beam (22) of the light barrier (24.1, 24.2) to generate the signal.
13. The device according to Claim 11,
20 characterized in that, in order to generate the signal, a region of the indicator (17), which is movable between the light barrier elements and screens light, has an opening (17.1) to cancel the interruption of the light beam (22) of the light barrier (24.1, 24.2) caused by the light-shielding region of indicator (17).
- 25 14. The device according to one of Claims 1 to 13,
characterized in that the fiber-optic system (24) has at least one further sensor region, preferably in the form of a further light barrier arrangement (124.1, 124.2), using which the position of the indicator cited (17) or a
30 further indicator (117) is detectable.
15. The device according to one of Claims 1 to 14,
characterized in that the indicator (17) has multiple indicator regions (17.10, 17.11, 17.12) having markings, the markings being detectable

alternately by the sensor region (24.1, 24.2) of the fiber-optic system (24).

16. The device according to one of Claims 1 to 15,
characterized in that it includes an optical/electronic converter (26),
coupled to the fiber-optic system (24), for converting the signals provided
by the fiber-optic system (24) into an electrical signal.

17. The device according to Claim 16,
characterized in that the optical/electronic converter (26) is coupled to a
computer unit (28), which is implemented for the purpose of using the
signal provided by the optical/electronic converter (26).

18. A firearm (1) having at least one device for detecting a state in a space
(10) and for transmitting a signal correlated to the state, this device

- including a sensor region (24.1, 24.2) for detecting the state and a
conductor arrangement (24.3), connected to the sensor region
(24.1, 24.2), for transmitting the signal, the sensor region (24.1,
24.2) and the conductor arrangement (24.3) being formed by a
fiber-optic system (24), and

- having a movable indicator (17), whose position corresponds to the
state to be detected in the space to be monitored (10) and which is
detectable by the sensor region (24.1, 24.2),

characterized in that

- the sensor region (24.1, 24.2) of the fiber-optic system (24) is
protected by a shielding device (20).

19. The firearm (1) according to Claim 18,
characterized in that the shielding device is a chamber (20) which encloses
the protected part of the indicator (17) and the sensor region (24.1, 24.2)
of the fiber-optic system (24) cited.

20. The firearm (1) according to one of Claims 18 to 19,
characterized in that the device has a feeler (16),

- which is implemented for sensing, preferably through scanning, the position of a movable part of the firearm (1) and
- whose movement may be coupled to the indicator (17) at least part of the time,
- the position of the indicator (17) being indirectly determined by the state to be detected in the space (10) to be monitored.

21. The firearm (1) according to one of Claims 18 to 19, characterized in that indicator (17) has a part projecting into the space to be monitored (10),

- which is implemented for sensing, preferably through scanning, the position of a movable part of the firearm (1) and
- the position of the indicator (17) being directly determined by the state to be detected in the space (10) to be monitored.

22. The firearm (1) according to one of Claims 18 to 19, characterized in that a wall of the shielding (20) has an opening (20.1), through which a part of the indicator (17) projects movably into the sensor region (24.1, 24.2) protected by the shielding (20).

23. The firearm according to Claim 22, characterized in that the opening (20.1) and the part of the indicator (17) projecting movably through the opening (20.1) each form a sealing surface, these sealing surfaces lying diametrically opposite one another and forming a sealing device (20.2) in the opening (20.1).

24. The firearm (1) according to one of Claims 18 to 22, characterized in that the state to be detected in the space (10) to be monitored is the setting of a locking element for a weapon barrel (2) of the firearm (1). (Section A-A, Figure 2A).

25. The firearm (1) according to one of Claims 18 to 23, characterized in that the state to be detected is the setting of a slide moved in synchronization with the cadence, which forms a clock of the firearm. (Section B-B, Figure 2B).

26. The firearm (1) according to one of Claims 18 to 24,
characterized in that the state to be detected in the space (10) to be
monitored is the occupation by a cartridge of a cartridge chamber located
5 in the firing position. (Section C-C, Figure 2C).
27. The firearm (1) according to one of Claims 18 to 25,
characterized in that the state to be detected in the space (10) to be
monitored is the setting of a firing pin. (Section D-D, Figure 2D).
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28. The firearm (1) according to one of Claims 18 to 26,
characterized in that the state to be monitored in the space (10) to be
monitored is the setting of a clutch. (Section E-E, Figure 2E).
- 15 29. The firearm (1) according to one of Claims 18 to 27,
characterized in that the state to be monitored in the space (10) to be
monitored is the state of the delivery of ammunition. (Section F-F, Figure
2F).
- 20 30. The firearm (1) according to Claim 18,
characterized in that it has at least two of the devices, which are coupled
to one another, in order to monitor, control, or regulate the time sequence
of the execution of different functions of the firearm (1). (Figure 3).