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- (73) Patenthaver: **BreveX S.A., Place Benjamin-Constant 2, 1003 Lausanne, Schweiz**
- (72) Opfinder: **BARCHERINI, Antonio, Le Resquidou, 24230 Montazeau, Frankrig**
- (74) Fuldmægtig i Danmark: **Dennemeyer & Associates S.A, P.O. Box 700425, DE-81304 Munich, Tyskland**
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## **SILENCER DEVICE FOR FIREARM**

The present invention relates to a silencer device for a firearm, in particular for a rifle or another long or short firearm, and to a method for silencing a firearm.

### **Technical field**

In accordance with a first aspect, the present invention relates more specifically to a silencer for a firearm, such as a rifle or another long or short firearm.

In accordance with a second aspect, the invention proposes a method for silencing a firearm, in particular a rifle or another firearm, when a shot is fired.

In accordance with a third aspect, the invention proposes a firearm, in particular a rifle, including an improved silencer device.

### **Prior art:**

With regard to the prior art, there exists the conventional silencer, also referred to as a noise regulator, which can be added to a firearm, gas weapon or air gun and which is aimed at mechanically reducing noise.

By way of example, publication WO 96/03612 discloses a noise moderating device for rifles for clay pigeon shooting or other recreational activities, having superposed barrels of all calibres. This firearm silencer is formed by a tubular encasement that is mounted on the barrel of the gun and includes an annular decompression chamber to the rear of said tubular encasement, as well as a series of internal cross baffles held by spacers and equipped with orifices allowing the passage of the lead shots and the wad. The silencer is intended to dampen the noise and thus reduce noise pollution.

Publications WO 2011/035111 A1 and WO 2014/000805 disclose further examples of firearm silencers, in particular for automatic rifles or another long or short firearm, including a silencer mounted on the barrel of the firearm, wherein a muzzle brake, which can be connected by screwing to the silencer, is fixed to the barrel.

DE2238834 A relates to a silencer device for a firearm, in particular for a rifle or another long or short firearm, and to a method for silencing a firearm.

### **Conventional silencer**

A conventional silencer or sound moderator is a device that can be added to a firearm, gas weapon or air gun in order to reduce the noise and light flash produced thereby when

a shot is fired, thus making the weapon in question more stealthy.

To do this, the silencer generally takes the form of a cylindrical tube able to be adapted to the mouth of the barrel, and the internal mechanism of said tube, which mechanism varies depending on the ammunition used, makes it possible to reduce the pressure of gases used to propel the projectile, so as to mitigate their release into the atmosphere to the greatest possible extent.

Since the silencer merely slows the gas at the outlet of the barrel, it has no effect on the noise produced by the passage of the projectile at supersonic speed (speed greater than the speed of sound, which is approximately 340 m/s in air at 15°C), which, by exceeding the sound barrier, in turn produces detonation noise over its path. The phenomenon is especially noticeable on calibres with high initial speed such as 5.56 mm. For some cartridge calibres, especially for handguns, subsonic ammunition is created specifically for use with a silencer, in order to minimise the noise of the shot.

A silencer is above all a comfort tool because it reduces the muzzle wave of a firearm. This muzzle wave is the cause of ENT traumas, in the ear, nose and throat area, which the usual means (ear plugs, helmets, etc.) cannot provide protection against.

It should be noted that the two main factors affecting the value of the speed of the sound are the density and spring rate (or compressibility) of the propagation medium:

The lower the density and compressibility of the medium, the more quickly the sound will propagate. These two parameters change from one medium to the next. In helium, the compressibility of which is almost equal to that of air, but the density of which is much lower under the same temperature and pressure conditions, the speed of the sound is almost three times greater than in air. In a gas at atmospheric pressure, the speed of the sound is much lower than in a liquid: although the density of the gas is much lower, the gas is almost infinitely more compressible than the liquid (which is often considered incompressible).

For example, the sound propagates exactly at 1,482.343 m/s in pure water at 20°C, approximately at 340 m/s in air at 15°C, and at around 1,500 m/s in seawater.

The effectiveness of silencers is relative; the noise reducer suppresses the muzzle wave and consequently the subsequent detonation and makes the noise thereof more diffuse whilst suppressing the flame at the mouth of the weapon. The term noise regulator is sometimes used; the performance of this type of device varies greatly depending on the type of noise reducer employed and the weapon used. The shorter the distance at which the shot can be heard, the more difficult it is to identify it as a shot from a firearm, and the more difficult it is to locate due to the distortion of the noise and also the absence of a

visible flame. The magnitude of the noise is reduced by the order of 25 to 35 dB in the case of an assault rifle, that is to say it is 115 to 125 dB (comparable to a pneumatic drill) instead of 150 dB. The conventional silencers, whilst being provided in different forms and utilising different techniques, are nevertheless all rather similar. They are generally constituted by sleeves that are fixed to the end of the barrel, either by a bayonet system or by a threaded screw.

These sleeves, of substantial size, include a plurality of gas expansion chambers in their interior, which make it possible to attenuate the noise of the detonation with varying levels of success. The projectile, the gases and the residual sound wave exit via the mouth.

Their faults are as follows: significant weight (several hundred grams, perhaps more than a kilo), large dimensions, imbalance of the weapon (the nose drops), impossibility of use in double-barrel weapons and also, for the most part, with shot ammunition.

In addition, since the diameter of the holes separating the various elements of the silencer through which the projectiles pass is much larger than the calibre, they allow some of the gases to escape to the front of the projectile, thus interfering with the accuracy of the projectile and reducing the speed thereof approximately by 4 to 6 m/s.

The conventional silencer is costly, is difficult to maintain (it must be completely disassembled, part by part, for cleaning) and, for some rifle models, its lifetime is less than 800 shots.

As it passes through the various baffles, the projectile allows the gases behind it to expand in the cells, thus reducing the magnitude of the sound wave.

The effectiveness of a silencer of this kind is down to two factors: its dimensions (the larger it is, the more it damps), and the distance separating it from the combustion chamber (the greater the distance, the greater the effectiveness). Since the silencer is situated at the end of the barrel, the longer the length of said barrel, the more effective the silencer will be, therefore. Furthermore, there is practically no effect at all if the silencer is used with weapons having a very short barrel, unless the silencer is greatly oversized.

In this type of silencer the reduction of the noise is dependent on the size of the chambers (cells). The noise normally produced by the detonation of a firearm is approximately from 120 to 170 dB. Thus, a sudden noise or extended exposure to excessive ambient noise (beyond 100 dB) may cause a temporary or permanent change to a person's hearing.

In addition, implementation difficulties are also encountered in particular for certain conventional silencers or those that are not effective enough to reduce the noise when a shot is fired with the firearm, which results in certain problems.

**Summary of the invention**

It is therefore clear that there is a need for a system which, to a large extent, makes it possible to overcome the above-described disadvantages encountered in the prior art.

The object of the invention is to provide an improved silencer device for a firearm, in particular for a rifle or another long or short firearm.

Whereas a conventional silencer, also referred to as a noise regulator, endeavours to mechanically reduce noise, the aim of the present invention is therefore to propose a device for eliminating and completely preventing the noise produced when a shot is fired by allowing it to deplete naturally, thus resulting in greater stealth.

The aim of the device is therefore to inhibit the sound wave (the noise) generated by the ammunition of a firearm.

This object is achieved, in accordance with the invention, in that the silencer device for a firearm has the features of the characterising part of claim 1.

More particularly, to this end, in accordance with the invention, this aim is achieved in that the aforementioned silencer device comprises:

- a flap mechanism (10) comprising at least one closing flap (10) mounted transversely to the axis on the barrel (42) of the firearm in order to temporarily seal the barrel after the passing of ammunition and to prevent the passage of the combustion gases and the sound wave towards the mouth of the barrel when a shot is fired,
- an actuation unit (31, 34, 35) including a mobile portion (31) arranged axially on the barrel of the firearm so as to move a control mechanism (6), the axially mobile portion (31) having an inner bore suitable for allowing the passage of ammunition,
- the control mechanism (6) including at least one amplitude lever arm (8) pivotably mounted on a pivot (7) attached to the barrel, each amplitude lever arm (8) being coupled to a separate closing flap (10),
- the mobile actuation unit (31, 34, 35) engaging with the control mechanism (6) to allow a transverse movement of said at least one closing flap (10) between an open position, in which the flap mechanism (10) allows ammunition to pass towards the mouth of the barrel (42), and a closed position, which prevents the passage of the combustion gases and the sound wave after the passing of ammunition, and
- an exhaust unit (11, 21-27) including at least one exhaust pipe (11, 21) arranged on the barrel upstream from the closing flap mechanism (10) in order to redirect the combustion gases and the sound wave and allow them to be discharged from the barrel.

Thus, in order to achieve this aim, the barrel is temporarily sealed with the aid of the

closing flap mechanism just after the passage of the projectile, and the combustion gases and the sound wave are redirected towards an expansion space for their final processing. Preferably, in one embodiment of the invention, the actuation unit includes a mobile portion (31) of the barrel, said portion being moved by the projectile as soon as said projectile has fully passed the flaps, and extended by a rod connected to the control ring. In accordance with the invention, in order to assure the motivity of the system as a whole, a small portion of the barrel is made mobile. The portion can be an end or middle portion. Preferably, as the projectile passes through the mobile part (31), the part is pushed axially forwards in the downstream portion (38) of the barrel by the pressure of the gases within the barrel. The axial movement of the mobile part (31) causes the flaps to close by means of the coupling of the amplitude lever arm (8) to the closing flap mechanism (10). In principle, in firearms manufactured directly with the device incorporated, the mobile part will be a middle part at the very least on long firearms.

In the case in which the mobile portion is a middle portion, it is joined to the portion of the barrel exiting from the flap seats and the end portion of the barrel.

The interior of the barrel (in which the projectile moves) is deconstructed into three perfectly aligned portions.

Preferably, the mobile part has a covering portion and a covered portion. In its covering portion, the mobile portion covers the barrel, and in its covered portion it is covered by the final portion of the barrel.

The length of the portion of the barrel that passes through the seat of the flaps in principle has a fixed length equal to the length of the bullet.

In its covered portion, the mobile part reproduces the portion of the barrel that exits from the flaps, and is covered in turn. The final part of the barrel that is mounted on the seats of the flaps contains the mobile part in full. The final portion of the barrel can be very short.

In the case in which the mobile portion is an end portion, said final portion forms the mouth of the barrel. This is the same configuration for BB guns and for chokes. Whereas for BB guns the mobile portion is preferably cylindrical and rather short, for shotguns the mobile portion preferably has the forms, the patterns and the length of a traditional choke.

The control mechanism preferably includes a guide and transmission ring capable of sliding over the barrel, the ring cooperating with the rod of the mobile portion so as to transmit the movement to the lever arms.

The closing flap(s) is/are preferably disposed in a seat placed across the axis of the barrel and are of a predetermined length and, if there are two flaps, are slightly offset from one

another along the axis of the barrel, such that they partially overlap one another in the closed position without contacting one another.

In one embodiment of the invention each flap includes an opening for receiving the end of the amplitude lever arm so as to transmit the pivoting movement of the amplitude lever and actuate the flap in a transverse direction relative to the axis of the barrel.

The guide ring preferably further comprises two wedge-shaped support parts having an angled-edge surface directed towards the flaps for enabling the actuation of the lever arms pivoting on the pivots and the closure of the flaps.

In one embodiment of the invention the control mechanism includes a first return spring associated with the guide ring such that said guide ring can resume its initial position, lowering the pressure of the gases.

In a preferred embodiment of the invention the exhaust unit also comprises an expansion space connected to said at least one exhaust pipe so as to receive the gases transported by said at least one exhaust pipe, the expansion space including vents for discharging the combustion gases from the expansion space.

The expansion space preferably comprises an inner tube connected to flaps capable of sealing the vents, in which tube the gases enter the expansion space via an opening made in the inner tube once said tube has been pushed to its end position and has thus sealed the vents, and, as the pressure reduces, the inner tube resumes its starting position owing to a return spring, thus allowing the combustion gases to be discharged from the expansion space via the vents when the sound wave has depleted naturally.

In a preferred embodiment of the invention the mobile portion of the substantially cylindrical actuation unit joins a portion of the barrel that passes through the seat of the closing flaps and an end portion of the barrel, and includes a covering portion and a covered portion separated by a shoulder, the covering cylindrical portion being able to cover the portion of the barrel that passes through the seat of the flaps, and the covered cylindrical portion being able to be covered by the end portion of the barrel.

Preferably, the final portion of the barrel comprises a receptacle including a first cylindrical portion able to receive the covering portion of the mobile part, and a second cylindrical portion of a smaller diameter able to receive the covered portion of the mobile part, the first cylindrical portion and the second cylindrical portion of the end portion being separated by a shoulder.

Preferably, the first cylindrical portion of the end portion is longer than the covering cylindrical portion of the mobile part so as to allow the axial movement of the mobile part, the second cylindrical portion of the end portion being substantially the same length as

the covered cylindrical portion of the mobile part.

Preferably, the covering portion of the mobile part has an inner diameter corresponding to the outer diameter of the portion of the barrel that passes through the seat, and has an outer diameter corresponding to the inner diameter of the first cylindrical portion of the end portion.

In a further preferred embodiment of the invention, the mobile portion of the substantially cylindrical actuation unit forms the end portion of the barrel and includes a covering portion and a final portion separated by a shoulder, the covering cylindrical portion of the mobile part being able to cover a portion of the barrel that passes through the seat of the closing flaps, and the end portion forming the mouth of the barrel.

Preferably, the covering portion of the mobile part comprises a receptacle including a cylindrical portion capable of receiving the cylindrical portion of the barrel that passes through the seat of the flaps and of enabling the axial movement of the mobile part, the cylindrical portion of the barrel being substantially the same length as the covering cylindrical portion of the mobile part.

Preferably, the covering portion of the mobile part has an inner diameter corresponding to the outer diameter of the portion of the barrel that passes through the seat of the flaps.

Preferably, for shotguns, the mobile part at the end of the barrel forms a choke of which the inner diameter decreases in the direction of the mouth of the barrel, the covering cylindrical portion covering the barrel, and the end portion including an inner conical portion having a maximum diameter that is equal to the inner diameter of the barrel and narrows towards the outlet zone of the barrel.

In another embodiment of the invention (not shown), a second pair of flaps independent of the first ones (or a single flap) is disposed at the outlet of the cartridge chamber and can be placed on automatic or semi-automatic weapons; these flaps actuated mechanically by separate discharge/reloading devices of the weapon serve to prevent combustion gases, the sound wave and the flash exiting via the open breech when the cartridge shell is ejected. This variant, using a second pair of flaps for automatic or semi-automatic weapons, can be used alone for simple modification of a weapon without resorting to the silencer, which, for its part, requires at least the replacement or the modification of the barrel.

In another embodiment of the invention the silencer device for a firearm, in particular for a rifle or another long or short firearm, comprises:

at least one closing flap mounted across the axis on the barrel of the firearm in order to temporarily seal the barrel after a projectile has passed and to prevent the passage of the

combustion gases and the sound wave towards the mouth of the barrel when a shot is fired,

an actuation unit including a mobile portion of the barrel downstream from the closing flap for moving the control mechanism by way of the passage of the projectile;

the control mechanism including at least one amplitude lever arm pivotably mounted on a pivot attached to the barrel, the amplitude lever arm being coupled to the closing flap, the actuation unit engaging with the control mechanism to allow a transverse movement of the closing flap between an open position, in which the flap allows ammunition to pass towards the mouth of the barrel, and a closed position, which prevent the passage of the combustion gases and the sound wave after the projectile has passed, and an exhaust unit including at least one exhaust pipe arranged on the barrel upstream from the closing flap in order to redirect the combustion gases and the sound wave and allow them to be discharged from the barrel.

In accordance with another aspect, the invention proposes a long or short firearm, in particular a rifle, comprising a silencer device of the aforementioned type, in which the barrel of the firearm comprises a fixing system formed by said pivots and a seat disposed across the axis of the barrel, said seat receiving said closing flap mechanism so as to fix the silencer device to the barrel removably.

To this end, in accordance with a further aspect, the invention proposes a method for silencing a firearm, in particular a rifle or for another firearm, when a shot is fired, the method comprising the following steps:

- temporarily sealing the barrel after a projectile has passed and preventing the passage of the combustion gases and the sound wave towards the mouth of the barrel when a shot is fired, by means of at least one closing flap mounted across the axis on the barrel of the firearm,
- moving a control mechanism by way of the action of the passage of the projectile in a mobile barrel portion;
- the control mechanism including at least one amplitude lever arm pivotably mounted on pivots attached to the barrel, each amplitude lever arm being coupled to a separate closing flap,
- generating, by means of the actuation unit and the control mechanism, a transverse movement of the closing flap between an open position, in which the flap allows a projectile to pass towards the mouth of the barrel, and a closed position, which prevents the passage of the combustion gases and of the sound wave after the projectile has passed, and

- redirecting the combustion gases and the sound wave and allowing them to be discharged from the barrel by means of an exhaust unit including at least one exhaust pipe disposed on the barrel and upstream from the closing flap.

Thus, in order to achieve this aim, the barrel is temporarily sealed with the aid of one or more closing flaps just after the passage of the projectile, and the combustion gases and the sound wave are redirected towards an expansion space for their final processing.

### **Sound waves when a shot is fired**

There are, in principle, three sound waves which are generated by a fired shot. Two are produced within the barrel, and the third one is produced outside the barrel.

Inside the barrel the first sound wave is that produced by the combustion of the explosive charge. The second is the famous “bang” produced by the projectile as it passes the sound barrier, which is the case for approximately 96% of ammunition. This “bang” occurring inside the barrel is not certain, but assumed; however, it is certain that it is never produced outside the barrel. To the human ear these two sound waves are perceived to be a single noise. The third sound wave is produced with the exit of the projectile from the barrel, similar to a whiplash in the air. Said third sound has a magnitude of from 72 to 80 dB and cannot in any way be controlled.

The combustion of the powder gives off an immediate heat of from 2500 to 3000 degrees Celsius, as well as 2 to 2.5 grams of gas which, not compressed, give a volume of approximately 1.12 m<sup>3</sup>.

The sound wave produced by the combustion and the bang moves (at this temperature) at approximately 1500-1800 m/s (immediate speed) whereas the projectile is still in a phase of acceleration and reaches its maximum speed only after having travelled a distance of approximately 60 cm.

According to the invention, the sound wave has three properties of interest: the first is that, when it encounters an obstacle, it rebounds (echo phenomenon), the second is that it does not propagate in a vacuum, and the third and most interesting for the silencer device of the present invention is that it has a short life. It is therefore not possible in any way to store a sound wave: by preventing it from propagating it disappears.

The sound wave does not stick to the projectile. Upon striking it, the wave rebounds to the rear of the breech, which for its part returns the wave towards the projectile. It passes back and forth endlessly between these two obstacles, until the projectile exits via the mouth of the barrel, at variable speed depending on the temperature of the medium through which it passes and that of the gases carrying it. The sound wave then

propagates in the air at the exit of the barrel.

Whereas a conventional silencer of the aforementioned kind, also referred to as a noise regulator, endeavours to mechanically reduce noise, the silencer of the present invention allows it to completely deplete naturally and manages to eliminate it completely by keeping the sound inside the barrel for a very short time.

In addition, the silencer device for a firearm of the present invention is advantageous in terms of weight (approximately 50 g in total), manufacturing cost and effectiveness. According to the invention, the sound wave produced within the barrel is completely destroyed because it is retained behind the flap(s).

Solely the noise produced by the sound wave generated outside the barrel thus remains. In fact, the silencer device for a firearm of the present invention allows the sound wave to deplete naturally and above all deals with the pressure generated by the gases. If there were no escape provided by an exhaust pipe, the gases would remain compressed within the barrel, keeping the flap(s) closed. They would expand solely at the opening of the rifle, without posing any danger but with some disadvantages.

In accordance with the invention it has been deemed preferable to increase the inner volume of the barrel by one or two exhaust pipes. This additional volume lowers the pressure of the gases and allows the flap(s) to open by means of the system of return springs, and allows the gases to escape naturally simultaneously in a forwards direction and via the end of the exhaust temporarily sealed by flaps of a size similar to those arranged on the barrel. The reduction in the pressure of the gases inside the barrel is also brought about by the quick cooling of said gases.

### **Brief description of the figures**

Further features and advantages of the invention will become clear from reading the following detailed description. Also, in order to provide a clearer understanding of the invention, several preferred embodiments will be described hereinafter by way of example, with reference in particular to the accompanying figures, in which:

- figure 1 shows a silencer device for a firearm in an embodiment of the invention,
- figure 2 is a partial side view in cross-section of the device as shown in figure 1,
- figure 3 is a side view of the device as shown in figure 1 prior to being assembled,
- figure 4 is a partial side view of the part 38 of the device as shown in figure 1,
- figure 5 is a partial side view in cross section of the part 38 of the device as shown in figure 1,
- figure 6 is a partial side view of the device as shown in figure 1,

- figure 7 is a partial side view of the device as shown in figure 1,
- figure 8 shows a silencer device for a firearm in another embodiment of the invention,
- figure 9 is a partial side view in cross-section of the device as shown in figure 8,
- figure 10 is a partial side view in cross-section of the device as shown in figure 8,
- figure 11 shows a silencer device for a firearm in another embodiment of the invention,
- figure 12 is a partial side view of the device as shown in figure 11,
- figure 13 is a side view of an exhaust unit of the silencer device for a firearm in an embodiment of the invention.
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### **Embodiments of the invention:**

The present invention is described on the basis of particular embodiments and with reference to the figures, however the invention is not limited thereto. The drawings or figures described are merely schematic and are not limiting.

Figure 1 shows a silencer device for a firearm in an embodiment of the invention.

In accordance with the preferred embodiment shown in figure 1, two closing flaps (10) are mounted across the axis on the barrel of the firearm in order to temporarily seal the barrel after a projectile has passed and to prevent the passage of the combustion gases and the sound wave towards the mouth of the barrel (42) when a shot is fired.

The closing flaps (10) are disposed in a seat (37) placed across the axis of the barrel and are of a predetermined length and are slightly offset from one another along the axis of the barrel, such that they partially overlap one another in the closed position without contacting one another.

The control mechanism (6) includes two amplitude lever arms (8) mounted on pivots (7) so as to allow a transverse movement of the two closing flaps (10) between an open position, in which the flaps (10) allow a projectile to pass towards the mouth of the barrel, and a closed position, which prevents the passage of the combustion gases and the sound wave after the projectile has passed.

The exhaust unit (11) includes two exhaust pipes (11) arranged upstream from the closing flaps (10) in order to redirect the combustion gases and the sound wave and allow them to be discharged from the barrel (42).

The control mechanism (6) is positioned upstream from the flaps (10).

The control mechanism (6) actuates the amplitude lever arms (8), which close the flaps (10), thus allowing the gases to be discharged via the pipes (11). The flaps (10) (and their seat 37) are preferably disposed across the axis of the barrel (42) and are of a predetermined length and are slightly offset from one another along the axis of the barrel,

such that they partially overlap one another in the closed position without contacting one another.

Advantageously, each flap (10) includes an opening for receiving the end of the amplitude lever arm (8) so as to transmit the pivoting movement of the amplitude lever (8) and actuate the flap (10) in a transverse direction relative to the axis of the barrel (42). The element (6) of the actuation mechanism is moved in a direction generally parallel to the axis of the barrel (42).

Preferably, the control mechanism (6) includes a guide ring (6) that is capable of sliding over the barrel and is connected to the rod of the mobile portion of the barrel (31) so as to transmit the movement to the lever arms (8).

Advantageously, as can be seen for example in figures 1-2, the guide ring (6) also includes two support parts disposed laterally to the axis of the barrel (42), each forming an elongate opening for receiving the end of one of the lever arms (8) and including an angled-edge (rectilinear or curvilinear) guide surface directed towards the flaps (10) for enabling the actuation of the lever arms (8) pivoting on the pivots (7) in order to close and open the flaps (10).

Alternatively, in an embodiment not shown, the guide ring (6) includes two wedge-shaped support parts disposed laterally to the axis of the barrel (42) and having an angled-edge (rectilinear or curvilinear) surface directed towards the flaps (10) for enabling the actuation of the lever arms (8) pivoting on the pivots (7) in order to close and open the flaps (10).

The passage of the projectile in the mobile portion of the barrel (31) pushes said portion forwards, thus pulling, by means of the rod, the ring (6) and transmitting the movement thereto, which allows this ring to actuate the lever arms (8) on the pivots (7), which close the flaps (10), the gases thus being diverted towards the exhaust (11).

The entire mechanism could be protected by a standard-use cover and could prevent damage when used with a firearm; however, this will be dependent on the weapon in question and its components. Since the cover is not essential for correct functioning, it will not be described in greater detail.

The two flaps (10) close the barrel once the bullet has passed through, such that the sound wave and the gases are redirected towards an expansion space. A second pair of flaps can be used to close the barrel from the outset in the case of automatic or semi-automatic weapons. The control ring (6) is actuated by the passage of the projectile after the flaps in a small portion (31) of the barrel which is mobile and connected to the control ring (6) by a rod. This portion (31) of the barrel (of the same calibre as the barrel) is placed after the flaps (10) at a distance therefrom equal to the length of the body of the projectile

(without any potential tip). This part (31) is mobile and moves by approximately 0.5 mm, which serves to close the flaps (10) immediately after the passage of the bullet. The proportion of the amplitude levers is dependent on the calibre of the firearm, the maximum being 10 for a single-barrel or superposed .12 calibre, and 20 for a juxtaposed (lateral) .12 calibre, because for this firearm it is necessary to have a single flap (10). The parts (31, 6, 8 and 10) are repositioned into the normal position by a return spring (32).

As can be seen in figure 2, the control mechanism (6) comprises a transmission rod and the mobile portion (31) includes a coupling assembly (34-36) for moving the control ring (6). The coupling assembly (34-36) comprises a connection arm (34) fixed to the mobile portion (31) by a connection screw (35) and attached to the transmission rod by a bolt and nut (36).

As can be seen in further detail in figures 6 and 7, which are partial side views of the device as shown in figure 1, the elongate opening formed in the transmission rod allows axial adjustment of the position of the rod relative to the connection arm (34) and to the mobile portion (31) by tightening of the nut (36).

The transmission rod is positioned in a direction generally parallel to the axis of the barrel defining the direction of the projectile. As the projectile passes a defined point, the mobile portion (31) is actuated axially and allows the transmission of the movement to the control mechanism (6) by coupling to the coupling assembly (34-36) and to the transmission rod. The control mechanism (6) having the rod is connected to the return spring (32) disposed on an anchor (33) for attachment to the barrel. As the axial force on the part (31) decreases, the rod and the control mechanism (6) resume their initial position thanks to the return spring (32).

### **Specific details**

In this version, the device can be incorporated in the weapon at the time of its manufacture, or can be added to an existing weapon in the form of extensions to the existing barrel(s), or in the form of an extension of the barrel(s) after shortening thereof. The addition is made by screwing, soldering, a nested configuration or any other means.

#### **1. Device incorporated in the weapon:**

In the case in which the device is incorporated in the weapon, as can be seen in figures 1 to 3, the part (31), as an extension of the barrel, is mobile, its start being situated after the flaps (10) at a precise distance corresponding to the length of the body of the projectile. When passing through said part, the projectile imparts an axial movement

thereon, which actuates the entire device and causes the flaps (10) to close completely and immediately. The gases and the sound wave are thus redirected via the exhaust (11) in order to be processed. The projectile continues its course in the portion (38) of the weapon, i.e. the extension of the barrel.

Since the axial force produced on the part (31) by the projectile is far greater than the needs of the device, it is possible to reduce said force by carefully increasing the diameter of said part (31), which is in principle of the same calibre as the barrel, or by adding a spring (not shown) around the straight portion of the part (31) that re-enters the part (38), or both.

It should be noted that the part (31) does not contact the end of the part (38) that receives it.

As can be seen in figure 3, the mobile part (31) is in the middle of the barrel. This mobile part (31) is joined to the portion of the barrel (42) exiting the seats (37) of the flaps (10) and the end portion (38) of the barrel. This mobile part (31) is cylindrical and comprises an inner bore capable of allowing the passage of a bullet. The interior of the barrel in which the projectile moves is deconstructed into three portions (42, 31, 38) which must be perfectly aligned.

The cylindrical mobile part (31) includes a covering portion and a covered portion separated by a shoulder.

In its covering cylindrical portion, the mobile part (31) covers the barrel (42), and in its covered cylindrical portion it is covered by the final portion of the barrel (38).

The length of the portion of the barrel (42) that passes through the seat (37) of the flaps (10) has a fixed length equal to the length of a bullet for this type of weapon. If the portion of the part (31) were to be covered instead of being covering, it could then recede inside the portion (42) and thereby prevent the flaps (10) from closing correctly.

In its covered portion, the part (31) reproduces the portion (42) that exits from the flaps (10), and is covered in turn. The part (38) that is mounted on the seats (37) of the flaps (10) will contain the part (31) in its entirety (figures 2 and 5).

As can be seen in figures 2 and 5, the final portion (38) of the barrel comprises a receptacle including a first cylindrical portion for receiving the covering portion of the mobile part (31) and a second cylindrical portion of a smaller diameter for receiving the covered portion of the mobile part (31). The first cylindrical portion and the second cylindrical portion of the final portion (38) are separated by a shoulder.

The first cylindrical portion of the final portion (38) is longer than the covering cylindrical portion of the mobile part (31) so as to allow the axial movement of the mobile part (31).

The second cylindrical portion of the final portion (38) can be the same length as the covered cylindrical portion of the mobile part (31). The final portion (38) of the barrel can be very short.

The covering portion of the mobile part (31) has an inner diameter corresponding to the outer diameter of the portion of the barrel (42) that passes through the seat (37), and has an outer diameter corresponding to the inner diameter of the first cylindrical portion of the final portion (38).

The covered portion of the mobile part (31) has an inner diameter corresponding to the inner diameter of the portion of the barrel (42) that passes through the seat (37), and has an outer diameter corresponding to the inner diameter of the second cylindrical portion of the final portion (38).

As can be seen in figure 3, the assembly can be performed in particular such that the device (31, 37, 38) is incorporated in the weapon at the time of its manufacture.

The seat (37) of the flaps (10) is fixed to the portion 38 of the weapon, i.e. the extension of the barrel. The straight portion of the mobile part (31) is inserted between the seat (37) and the part 38. The connection arm (34) and the part (35) are added to the part 31 after assembly.

As can be seen in figures 4 and 5, the part (38) of the device as shown in figure 1 forms the end portion (38) of the barrel and includes a portion intended for assembly on the seat (37) of the flaps (10) and for receiving the mobile part (31).

By way of example, in the case of a .30 calibre Blaser rifle, with particular reference to figures 1 to 3, the specific dimensions recommended for the device incorporated in the weapon can be as follows:

### **.30 calibre Blaser rifle**

- Diameter of the projectile: 7.85 mm
- Inner diameter of the barrel at the height of the grooves: 7.6 mm
- Outer diameter of the barrel 15 mm
- Length of the bullet body (without the pointed portion): 20 mm
- 

### Portion of the barrel (42) that exits from the seat of the flaps (37)

- Length: 20 mm
- Inner diameter 7.6 mm
- Outer diameter: 10 mm
- Mobile part (31)

- Total length 24 mm

*Covering portion:*

- Length: 20 mm
- Outer diameter: 12 mm
- Inner diameter: 10.2 mm

*Covered portion:*

- Length: 4 mm
- Outer diameter: 10.2 mm
- Inner diameter: 7.6 mm

-

#### Portion 38

- Outer diameter: 15 mm (irrelevant length)
- Inner diameter of the first portion: 12.2 mm over 23 mm length (the part 31 will thus have a stroke of 3 mm)
- Inner diameter of the second portion: 10.2 mm over 4 mm length
- Inner diameter of the final portion: 7.6 mm to the end

-

#### 2. Device added to existing weapons:

In the case in which the device is added to existing arms, it is necessary to distinguish between BB guns and shotguns.

Indeed, in BB guns the calibre of the barrel is the same over its entire length, whereas for the majority of shotguns the barrel ends with a narrowing referred to as a choke, of varying dimensions depending on the desired performance.

In shotguns it is well known that when a cartridge is detonated, the impact of the lead has a certain dispersion, which increases proportionally to the distance at which the impact occurs. This dispersion can be influenced by the use of what is known as a choke. In particular, various types of chokes or throttles can be mounted on the barrels of a rifle in order to reduce the exit diameter thereof so as to increase the range of the shot and limit the spray of the projected leads.

It is therefore clear that, on the one hand, it is necessary to retain the possibility of choosing a suitable choke in the weapons, and that, on the other hand, if a single final part is used, there will be an increase of the axial force on this part.

Thus, for BB guns, a configuration as in figures 8 and 9 is used. For shotguns, however, the configuration of figure 10 is used. This version provides mobile parts (31) that are interchangeable with appropriate chokes.

The alternative for shotguns is to use a mini-part (38) at the outer end of which a choke of the aforementioned type can be screwed on (figure 10), thus forming a throttling or narrowing to be mounted on the barrel in order to reduce the exit diameter, so as to increase the range of the shot and limit the spray of the projected shot material.

Figures 8, 12 and 9 (exploded) show a mobile part (31) mounted at the final portion of the barrel. This is the same configuration for bullets and for chokes. Whereas for BB guns the portion (31) is cylindrical and rather short, for shotguns the portion (31) has the forms, the configurations and the length of a traditional choke (figure 10).

As can be seen in figures 8 and 9, the mobile part (31) is at the end of the barrel. This mobile part (31) is mounted on the portion of the barrel (42) exiting from the seats (37) of the flaps (10). This mobile part (31) is cylindrical and comprises an inner bore capable of allowing the passage of a bullet. The interior of the barrel in which the projectile moves is deconstructed into two portions (42, 31) which must be perfectly aligned.

The cylindrical mobile part (31) includes a covering portion and a final portion separated by a shoulder.

In its covering cylindrical portion, the mobile part (31) covers the barrel (42), and in its final cylindrical portion it forms the mouth of the barrel.

In its final portion, the part (31) reproduces the portion (42) that exits from the flaps (10).

The part (31) is mounted on the portion (42) that exits from the flaps (10) (figure 9).

As shown in figure 9, the covering portion of the mobile part (31) comprises a receptacle including a cylindrical portion capable of receiving the cylindrical portion of the final portion (42) of the barrel and of enabling the axial movement of the mobile part (31). The cylindrical portion of the final portion (42) can be the same length as the covering cylindrical portion of the mobile part (31). The final portion (38) of the barrel can be very short.

The covering portion of the mobile part (31) has an inner diameter corresponding to the outer diameter of the portion of the barrel (42) that passes through the seat (37).

By way of example, in the case of a .30 calibre Blaser rifle, with particular reference to figures 8 and 9, the specific dimensions recommended for the device added to the existing weapon can be as follows:

**.30 calibre Blaser rifle**

- Diameter of the projectile: 7.85 mm
- Inner diameter of the barrel at the height of the grooves: 7.6 mm
- Outer diameter of the barrel 15 mm

- Length of the bullet body (without the pointed portion): 20 mm

- 

Portion of the barrel (42) that exits from the seat of the flaps (37)

- Length: 20 mm

- Inner diameter 7.6 mm

- Outer diameter: 10 mm

- 

Mobile part (31)

- Total length 24 mm

- Outer diameter 15 mm

*Covering portion:*

- Length: 20 mm

- Inner diameter: 10.2 mm

*Final portion:*

- Length: 4 mm

- Inner diameter: 7.6 mm

As shown in figure 10 the mobile part (31) is at the end of the barrel and forms a choke used in particular for shotguns, the choke forming a passage for the lead, which extends into the extension of the barrel and the inner diameter of which reduces in the direction of the mouth of the barrel. As can be seen in figure 10, the cylindrical mobile part (31) includes a covering portion and a final portion separated by a shoulder.

In its covering cylindrical portion, the mobile part (31) covers the barrel (42), and in its final portion forming the mouth of the barrel it includes a conical portion having a maximum diameter that is equal to the inner diameter of the barrel and narrows towards the outlet zone.

As shown in figure 11, for all the embodiments, it is possible to increase the resistance of the part (31) to axial movement by means of return springs (40) placed between an element (41) of the part (31) and a rod (39) fixed to the seat (37) of the flaps (10) so as to allow the part (31) to resist axial movement and resume its initial position. The version of figure 11 is similar to figures 8, 12 and 9 and shows a reinforced version of the portion (31) in a final position.

It should be noted that the bullet length of shotguns corresponds approximately to the length of the wad. This is dependent on the ammunition employed and the length of the rifle chamber. The length of the latter is 68 mm (virtually obsolete), 70 mm, 76 mm and 82 mm.

It goes without saying that a longer chamber can use shorter cartridges, the opposite being impossible in principle and not recommended. The length of a skirted wad for a 70 mm ammunition is approximately 40 mm. The part 6 provides an adjustment mechanism for adaptation.

Incorrect use of ammunition or a malfunction of the device can result in damage. In our tests the use of 2-mm thick aluminium flaps gave excellent results. Aluminium flaps intentionally left closed when a shot is fired were passed by the projectiles, even shot material, without any consequence.

As can be seen in figure 13, in accordance with a preferred embodiment of the invention, an expansion space having a timer (22-27) is associated with the exhaust pipes (21) for processing the recovered gases and inhibiting the sound wave. Further solutions are possible.

In accordance with the embodiment shown in figure 13, the expansion space (27) is coupled to the exhaust pipes (21) and comprises an internal bar (23) moved by the pressure of the gases in order to redirect these gases. The expansion space 27 receives the gases carried by the recovery pipes (21), which gases enter the expansion space 27 via the opening (22) made in the bar (23) once said bar has been pushed to its end position and has thus sealed the openings (24). A pressure relief valve (25) is provided (but could be replaced by small holes). As the pressure reduces, the bar resumes its starting position owing to the return spring (26) and the gases are discharged via the vents (24).

### **Operating principle and details**

The final aim of the device provided by the invention described here is that of inhibiting the sound wave produced by the firing of the ammunition (rifle shot).

This stopper intended to inhibit the sound wave produced by the firing of the ammunition (rifle shot) prevents the combustion gases and sound waves from exiting via the mouth of the barrel by diverting them towards a suitable processing zone, whilst leaving the properties of the ammunition itself (speed, accuracy, etc.) unaffected.

### **Principle**

- a) a sound wave has a short life;
- b) it cannot be preserved;
- c) it is stopped by any obstacles (in which case it rebounds – resonance cavity), whether said obstacle is stationary or is moving;

d) it does not propagate in a vacuum;

when a shot is fired, two sound waves are in principle generated within the barrel, one each by the following:

- 1) the detonation produced by the explosion;
- 2) the typical “bang” when the sound barrier is passed;

the sound waves follow the projectile; although the speed of sound in a gaseous medium is variable (it can reach very high values depending in particular on the temperature of the gases), the sound wave does not stick to the projectile within the barrel; if the speed of the wave is greater than that of the projectile, the wave moves back and forth within the barrel. The speed of the projectile may vary between 250 and 950 m/s depending on the calibre and type of ammunition.

### **Practical application:**

Recognising that the maximum speed of a projectile is reached after 60 cm of travel in practice, after this distance an opening of suitable size to redirect the gases is made in the barrel, and, just after this opening, a transverse rail having a left-hand flap and a right-hand flap (or lower and upper flaps) is incorporated into the barrel, each flap intended to seal a transverse half of the barrel by superposition. The two flaps are actuated by an amplitude lever. The lever(s) of each flap is/are implemented by a control moved by the passage of the projectile, which pushes a mobile portion of the barrel forwards.

This is effective for weapons referred to as long weapons; for short weapons the position of the device is selected accordingly.

The mechanism is preferably formed of:

- i) a mechanical or hydraulic closure valve having one flap (solid or hinged) or preferably having two juxtaposed flaps (two halves overlapping one another, improved solution because it is quicker), having a diaphragm (of the camera shutter type), having a blade; return spring;
- ii) a control device and kinetic motivity by gas recovery;
- iii) a sealed expansion space;
- iv) possibly an autonomous device for resetting;

the disc valve (one flap or dual flaps) closes the barrel just after the projectile has passed through, after which said projectile will have travelled between 0.5 and 1 mm after the flaps, this distance being freely selected by the amplitude coefficient applied to the levers.

The tests performed successfully were:

- A) silencing of the gases in the expansion space;

B) closure of the barrel after passage of the projectile by means of a disc valve; in summary there is:

- i) one closing flap or two opposite closing flaps on two slightly offset axes, so as to avoid contact;
- ii) control device (kinetic motivity by way of the thrust of the projectile) with spring return;
- m) amplitude lever mechanisms on each side;
- iv) opening(s) for redirecting the gases;

all of the measurements of the components must be defined depending on the calibre of the weapon and the maximum length of the projectile, minus the pointed portion before the shoulder if applicable;

the total amplitude factor established by the levers will be defined depending on the calibre;

the residual noise is that created by the projectile flying through the air.

In accordance with the invention, the motivity of the device is assured solely by the passage of the bullet in the part (31) that is mobile (displacement in the order of max. one millimetre).

In all firearms, the cross section of the barrel is very slightly smaller than the calibre of the bullet, so as to assure a lateral tightness to best utilise the pressure of the gases. Thus, as soon as the bullet, which is travelling from left to right in relation to the drawings (for example figure 2), has passed the flaps (10) over its entire length, it enters the mobile portion of the barrel (31), imparting an axial forward movement thereon. The mobile part (31) actuates the control ring (6) which, by also moving from left to right, closes the flap(s) (10) by means of the lever arms (8). The gases and the sound wave are thus deflected by the exhaust(s) (11). The parts (31, 6, 8 and 10) resume the initial position thanks to the return spring (32).

According to the invention, either the device is incorporated in the barrel during its manufacture (in which case the device is located well upstream from the mouth of the barrel, and therefore a barrel end is added after the part (31) or the part 38) – as shown by the drawings (figure 2) – or the device is attached to the end of the barrel on the mouth side (figure 8), extending the existing weapon or replacing a portion of the existing weapon, after having shortened it consequently. This addition can be made by a number of methods: soldering, screwing, bayonet connection, etc.).

In addition, the proportion of the amplitude arms is directly dependent on the calibre of the weapon: 1 to 4 for 8 mm (bullet), 1 to 10 for a .12 calibre (shot material), and is thus fixed.

**Processing of the gases and sound wave**

The closing mechanism consists of lever arms (8) actuated by a part (6), the shape of which can be variable.

Once the projectile has passed the flaps, these close directly behind and the gases are directed towards one or two exhaust pipes leading to an expansion space having a timer. The gases carried by the recovery pipes (21) enter the expansion space via the opening (22) made in the bar (23) once said bar has been pushed to its end position and has thus sealed the openings (24). A pressure relief valve (25) is provided (but could be replaced by small holes). As the pressure reduces, the bar resumes its starting position owing to the spring (26) and the gases are discharged via the vents.

**Operating sequence**

Once it has entirely and fully passed the open flaps, the projectile penetrates a mobile portion of the barrel (31), pushing it forward. Because the rod of this portion (31) is connected to the ring (6), it pulls the ring forward, with the result of actuating the lever arms (8) on the pivots (7), which close the flaps (10), the gases thus being diverted to the exhaust (11) and then processed in the expansion space (27).

In accordance with a preferred embodiment of the invention, for a long firearm, the following should therefore be noted:

exhaust openings should be made after a distance of 60 centimetres, to which the expansion space will be applied tightly, said openings being of a size suitable to contain the combustion gases; this expansion space (27) could have any shape and could be made of any material (solid or resilient); it could be applied at any point of the weapon (for example laterally on the barrel or beneath);

Just downstream of these openings, there should be a flap (10) support incorporated during the process for manufacturing or modifying the barrel;

The flap device should be actuated by a linkage.

The movement of the device as a whole is controlled by the thrust exerted by the projectile on the mobile portion of the barrel (31).

The amplitude coefficient is calculated depending on the calibre in such a way that the flaps close immediately after the passage of the projectile, allowing it to advance by less than a millimetre.

**Nomenclature****No. Part name**

6 control ring  
7 pivots  
8 lever arms  
10 flaps  
11 exhaust pipes  
31 mobile portion  
32 return spring  
33 spring anchoring  
34 connection rod or arm  
35 connection screw  
36 bolt and nut  
37 flap seats  
38 final portion with barrel  
39 reinforcement rod  
40 retention spring  
41 reinforcement anchoring  
42 barrel  
21 exhaust junction  
22 opening in bar  
23 bar and flaps  
24 vent openings  
25 pressure relief valve  
26 return spring  
27 expansion space

**Final considerations**

All the parts, their form and their positions can vary without limitation. The recovery or exhaust pipes can be reduced to just one and are not necessarily tubular, the expansion space can be of a different shape, and the control mechanism 6 shown by a full circular ring could be in the form of a circular arc, etc.

The present invention is not in any way limited to the embodiment described by way of example and shown in the drawings. Numerous modifications of the details, shapes and dimensions could be made without departing from the scope of the invention as defined

by the appended claims.

The present invention has been described with reference to specific embodiments which are purely illustrative and should not be considered limiting. The reference numbers in the claims do not limit the scope thereof.

## LYDDDÆMPER TIL SKYDEVÅBEN

**PATENTKRAV**

1. Lydddæmper til skydevåben, navnlig til et gevær eller et andet langt eller kort skydevåben, hvilken lyddæmper omfatter:

en klapmekanisme (10), der omfatter mindst en lukkeklap (10), der er monteret på tværs af aksen på skydevåbenets løb (42) for midlertidigt at blokere løbet efter passage af en ammunition og forhindre passage af forbrændingsgasserne og lydbølgen mod løbets munding, når der er afgivet et skud,

en aktiveringsenhed (31, 34, 35), der omfatter en bevægelig del (31), der er placeret aksialt på skydevåbenets løb, til bringe en styremekanisme (6) i bevægelse, hvilken aksialt bevægelig del (31) omfatter en indvendig boring, der er tilpasset til at muliggøre passage af en ammunition,

hvilken styremekanisme (6) mindst omfatter én amplitudevippearms (8), der er drejbart monteret på en drejetap (7) fastgjort til løbet, hvor hver amplitudevippearms (8) er sammenkoblet med henholdsvis en lukkeklap (10),

hvilken aktiveringsenhed (31, 34, 35) samvirker med styremekanismen (6) for at muliggøre en tværgående bevægelse af den mindst ene lukkeklap (10) mellem en åben position, hvori klapmekanismen (10) sikrer passage for ammunitionen mod løbets (42) munding, og en lukket position, der forhindrer passage af forbrændingsgasserne og lydbølgen efter ammunitionens passage, og

en udstødningsenhed (11, 21-27), der mindst omfatter et udstødningsrør (11, 21), der er placeret på løbet opstrøms for lukkeklapmekanismen (10), til at omdirigere og lade forbrændingsgasserne og lydbølgen forlade løbet.

2. Lyddæmper ifølge krav 1, hvor den bevægelige del (31) af aktiveringsenheden (31, 34, 35) i alt væsentligt er cylindrisk (31) og tilpasset til indsætning i et rum inde i løbet, hvilken bevægelig del (31) danner den indvendige boring af den bevægelige del (31), der har en diameter i alt væsentligt svarende til løbets (42) indvendige diameter 10 for at muliggøre ammunitionens passage.

3. Lyddæmper ifølge krav 1 eller 2, hvor styremekanismen (6) omfatter en transmissionsstang og den bevægelige del (31) omfatter en koblingsenhed (34-36), der er sammenkoblet med transmissionsstangen for at bringe styremekanismen (6) i bevægelse i en retning generelt parallel med løbets (42) akse.
4. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor styremekanismen (6) omfatter en førings- og overføringsring (6), der er tilpasset til at glide på løbet, hvilken ring (6) samvirker med stangen og den bevægelige del (31) for at overføre bevægelsen til vippearmen (8).
5. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor klapmekanismen (10) omfatter to lukke(10)klapper (10), der er placeret i et sæde (37) placeret på tværs af løbets akse, og som har en forudbestemt længde og er let indbyrdes forskudt langs løbets (42) akse, således at de i lukket position delvist dækker hinanden uden at støde sammen.
6. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor klapmekanismen (10) omfatter to lukke(10)klapper (10), hvor hver klap (10) omfatter en åbning, der er tilpasset til at modtage enden af amplitudevippearmen (8) for at overføre en drejebevægelse af amplitudevippearmen (8) og aktivere klappen (10) i en tværgående retning i forhold til løbets akse.
7. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor klapmekanismen (10) omfatter to lukke(10)klapper (10) og føringsringen (6) endvidere omfatter to basisdele placeret lateralt for løbets akse, der hver danner en aflang åbning til modtagelse af enden af én af vippearmene (8) og til at muliggøre aktivering af vippearmene (8) ved drejning på drejetapperne (7) for at lukke og åbne klapperne (10).
8. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor styremekanismen (6) mindst omfatter en første returfjeder (32), der er forbundet med føringsringen (6), således at den genfinder sin udgangsposition, når gastrykket falder.
9. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor udstødningsenheden (11, 21-27) endvidere omfatter en ekspansionsbeholder (27), der er

forbundet med mindst ét udstødningsrør (11, 21), til at modtage gasser befordret af det mindst ene udstødningsrør (11, 21), hvilken ekspansionsbeholder (27) omfatter åbninger (24), der gør det muligt for forbrændingsgasserne og lydbølgen at forlade ekspansionsbeholderen (27).

10. Lyddæmper ifølge krav 9, hvor ekspansionsbeholderen (27) omfatter et indvendigt rør (23) forbundet med klapper, der er tilpasset til at blokere åbningerne (24), og hvor gasserne trænger ind i ekspansionsbeholderen (27) via en åbning (22) tilvejebragt i det indvendige rør (23), når dette er skubbet til dets endeposition og således har blokeret åbningerne (24), og, når trykket falder, det indvendige rør (23) genfinder sin udgangsposition ved hjælp af en returfjeder (26), hvorved forbrændingsgasserne og lydbølgen kan forlade ekspansionsbeholderen (27) via åbningerne (24).

11. Lyddæmper ifølge et hvilket som helst af de foregående krav, hvor den bevægelige i alt væsentligt cylindriske (31) del (31) af aktiveringsenheden (31, 34, 35) forbindes med en del af løbet (42), der går gennem lukkeklapmekanismens (10) sæde (37) og en endedel af løbets endedel (38), og omfatter en afdækkende del og en afdækket del adskilt af en skulder, hvor den afdækkende, cylindriske del er tilpasset til at dække den del af løbet (42), der går gennem klapmekanismens (10) sæde (37), og hvor den afdækkede del er tilpasset til at blive afdækket af løbets endedel (38).

12. Lyddæmper ifølge krav 11, hvor løbets endedel (38) omfatter et rum omfattende en første cylindrisk del, der er tilpasset til at modtage den bevægelige endedels (31) afdækningsdel, og en anden cylindrisk del med en mindre diameter, der er tilpasset til at modtage den bevægelige dels (31) afdækkede del, hvor den første cylindriske del og den anden cylindriske del af endedelen (38) er adskilt fra hinanden af en skulder.

13. Lyddæmper ifølge krav 12, hvor den første cylindriske del af endedelen (38) er længere end den afdækkende del af den bevægelige del (31) for at muliggøre aksial bevægelse af den bevægelige del (31), hvor den anden cylindriske del af endedelen (38) i alt væsentligt har samme længde som den afdækkede, cylindriske del af den bevægelige del (31).

14. Lyddæmper ifølge et hvilket som helst af kravene 12 eller 13, hvor den bevægelige dels (31) afdækkende del har en indvendig diameter svarende til den løbets (42) udvendige diameter, som går gennem sædet (37), og en udvendig diameter, der svarer til den indvendige diameter af endedelens (38) første cylindriske del.

15. Lyddæmper ifølge et hvilket som helst af kravene 1 til 10, hvor aktiveringsenhedens (31, 34, 35) bevægelige, i alt væsentligt cylindriske del (31) del (31) danner løbets endedel og omfatter en afdækkende del og en endedel adskilt af en skulder, hvor den cylindriske, afdækkende del af den bevægelige del (31) er tilpasset til at dække en del af løbet (42), der går gennem lukkeklapmekanismens (10) sæde (37), og hvor endedelen danner løbets munding.

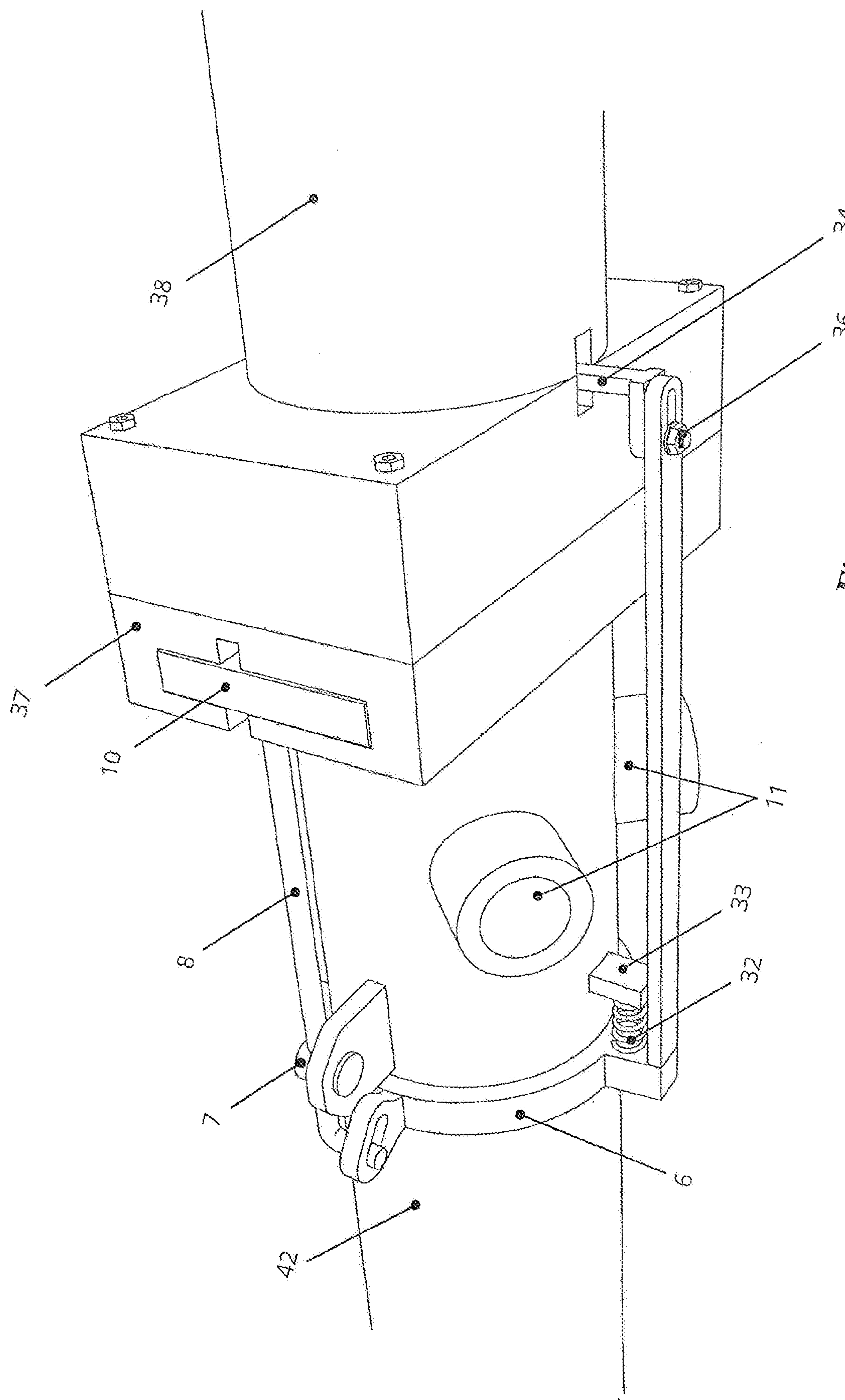
16. Lyddæmper ifølge krav 15, hvor den afdækkende del af den bevægelige del (31) omfatter et rum omfattende en cylindrisk del tilpasset til at modtage løbets (42) cylindriske del, som går gennem klapmekanismens (10) sæde (37) og muliggør aksial bevægelse af den bevægelige del (31), hvor løbets (42) cylindriske del i alt væsentligt har samme længde som den afdækkende cylindriske del af den bevægelige del (31).

17. Lyddæmper ifølge et hvilket som helst af kravene 15 eller 16, hvor den bevægelige dels (31) afdækkende del har en indvendig diameter svarende til den løbets (42) udvendige diameter, som går gennem klapmekanismens (10) sæde (37).

18. Lyddæmper ifølge et hvilket som helst af kravene 15 til 17, hvor løbets bevægelige endedel (31) danner en forsnævring, hvis indvendige diameter reduceres mod løbets munding, hvor løbets (42) afdækkende, cylindriske del og endedelen omfatter en indvendig konisk del med en maksimal diameter svarende til løbets indvendige diameter og indsnævres mod løbets mundingsområde.

19. Kort eller langt skydevåben, navnlig et gevær, der omfatter en lyddæmper ifølge et hvilket som helst af de foregående krav, hvor skydevåbenets løb omfatter et fastgørelsessystem, der er dannet af tapperne (7), og et sæde (37), der er placeret på tværs af løbets akse, hvilket sæde modtager lukkeklapmekanismen (10) for fastgørelse af lyddæmperen på løbet.

20. Fremgangsmåde til lyddæmpning af et skydevåben, navnlig et gevær eller andet langt eller kort skydevåben, når skuddet affyres, hvilken fremgangsmåde omfatter følgende trin: midlertidig blokering af løbet efter passage af en ammunition og forhindring af passage af forbrændingsgasserne og lydbølgen mod løbets (42) munding, når der er afgivet et skud, ved hjælp af en klapmekanisme (10), der omfatter mindst én lukkeklap (10), der er monteret på tværs af løbets akse på skydevåbenet, at bringe en aktiveringsenhed (31) og en styremekanisme (6) i bevægelse ved stødet af en ammunition, der passerer gennem en bevægelig del (31) af aktiveringsenheden (31) aksialt placeret på skydevåbenets løb, hvilken aksialt bevægelig del (31) omfatter en indvendig boring, der er tilpasset til at muliggøre en ammunitions passage, hvilken styremekanisme (6) mindst omfatter én amplitudevippearms (8), der er drejbart monteret på en drejetap (7) fastgjort til løbet, hvor hver amplitudevippearms (8) er sammenkoblet med henholdsvis en lukkeklap (10), at generere, ved hjælp af aktiveringsenheden (31) og styremekanismen (6), en tværgående bevægelse af den mindst ene lukkeklap (10) mellem en åben position, hvori klapmekanismen (10) sikrer passage for en ammunition mod løbets (42) munding og en lukket position, der forhindrer passage af forbrændingsgasserne og lydbølgen efter ammunitionens passage, og at omdirigere og lade forbrændingsgasserne og lydbølgen forlade løbet ved hjælp af en udstødningsenhed (11, 21-27), der mindst omfatter et udstødningsrør (11, 21) placeret på løbet (42) opstrøms for lukkeklapmekanismen (10).



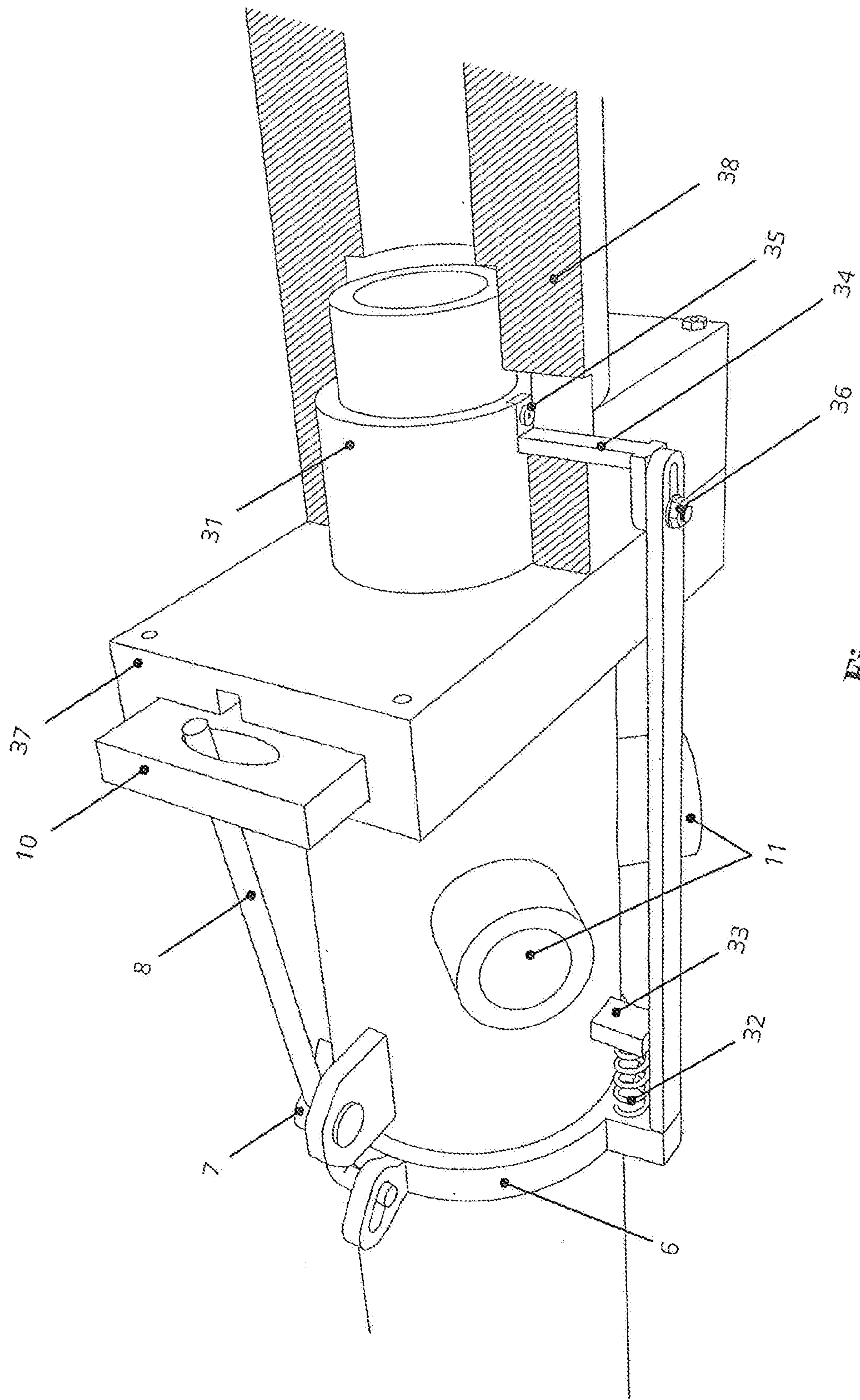


Fig. 2

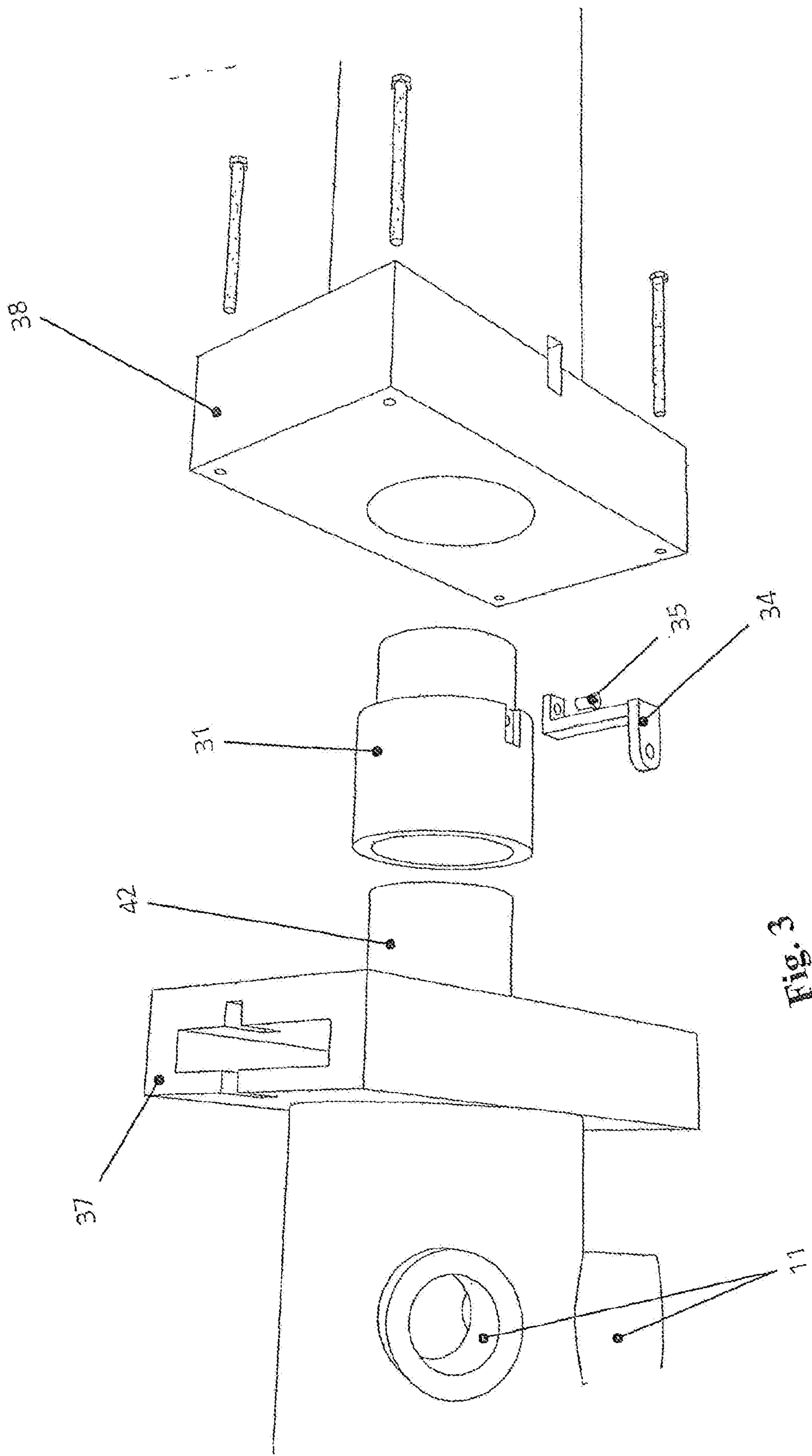


Fig. 3

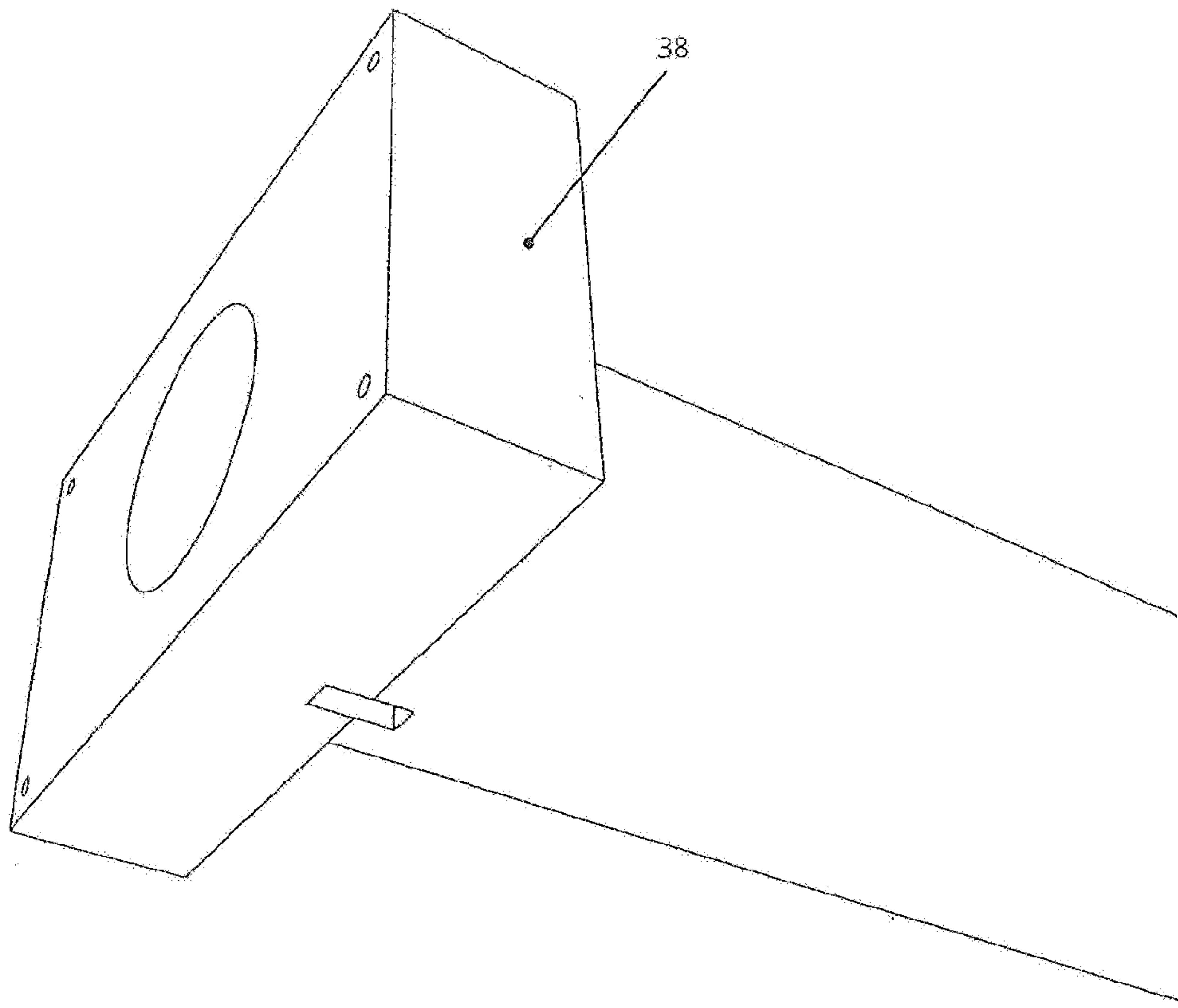


**Fig. 4**

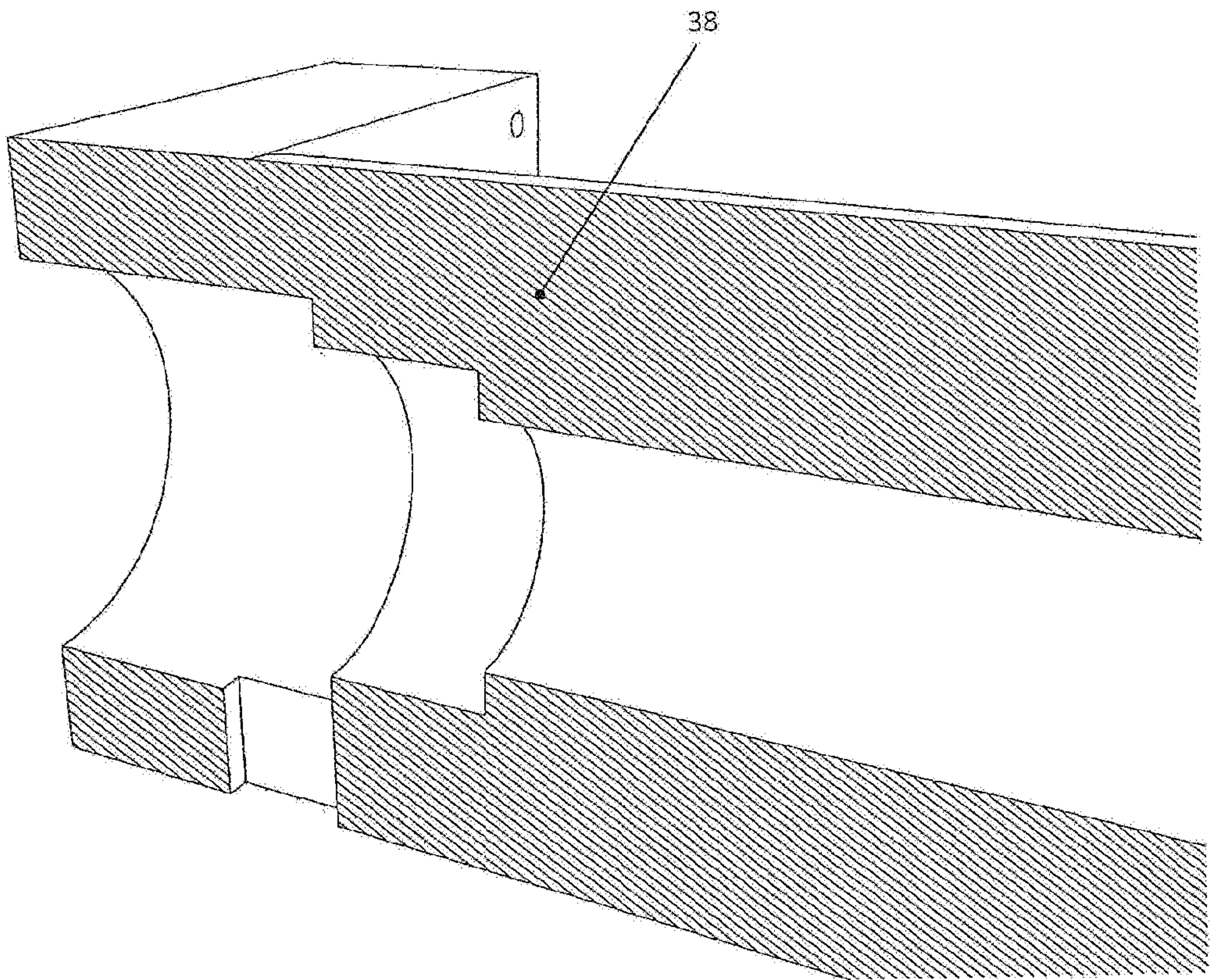


Fig. 5

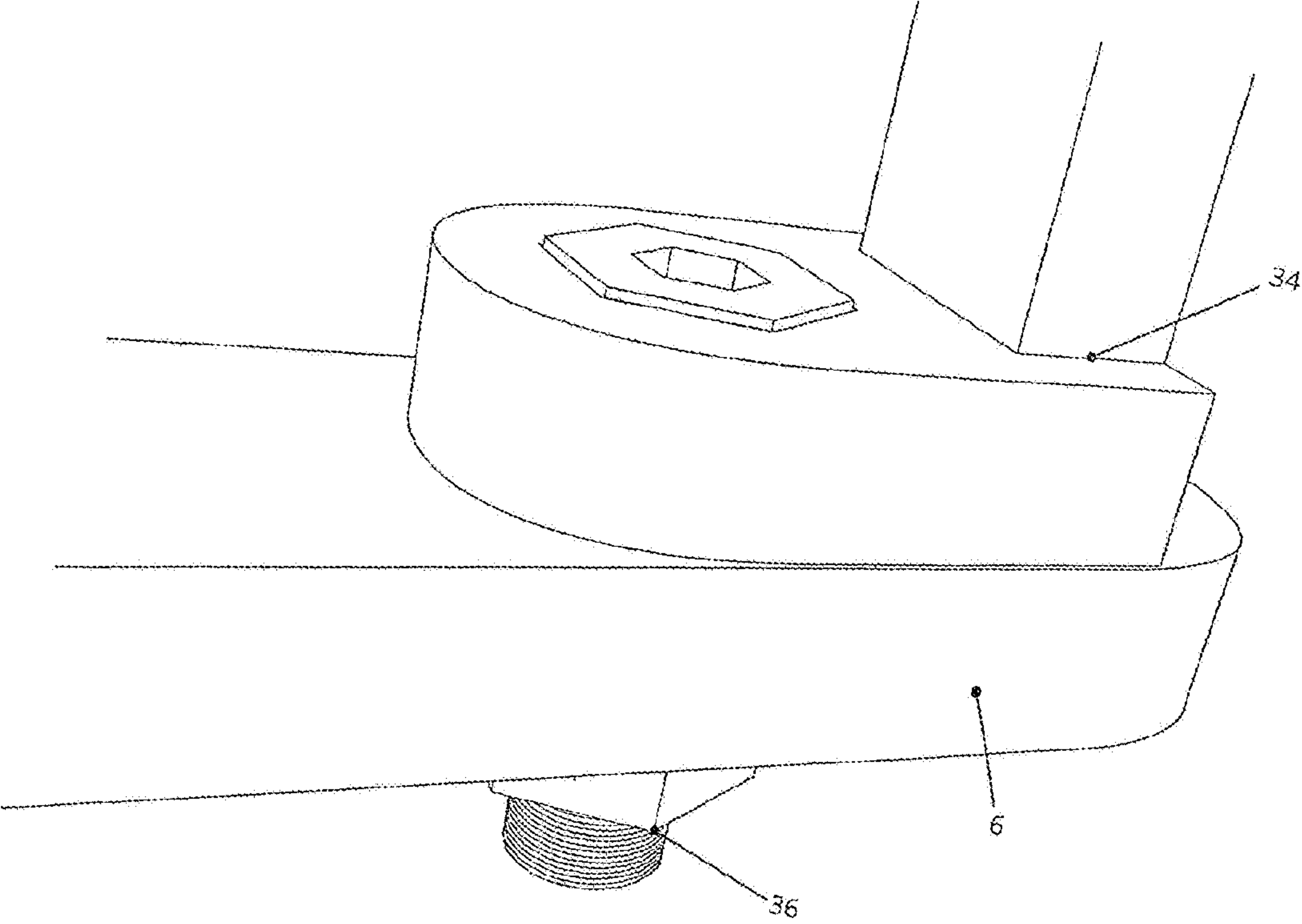


Fig. 6

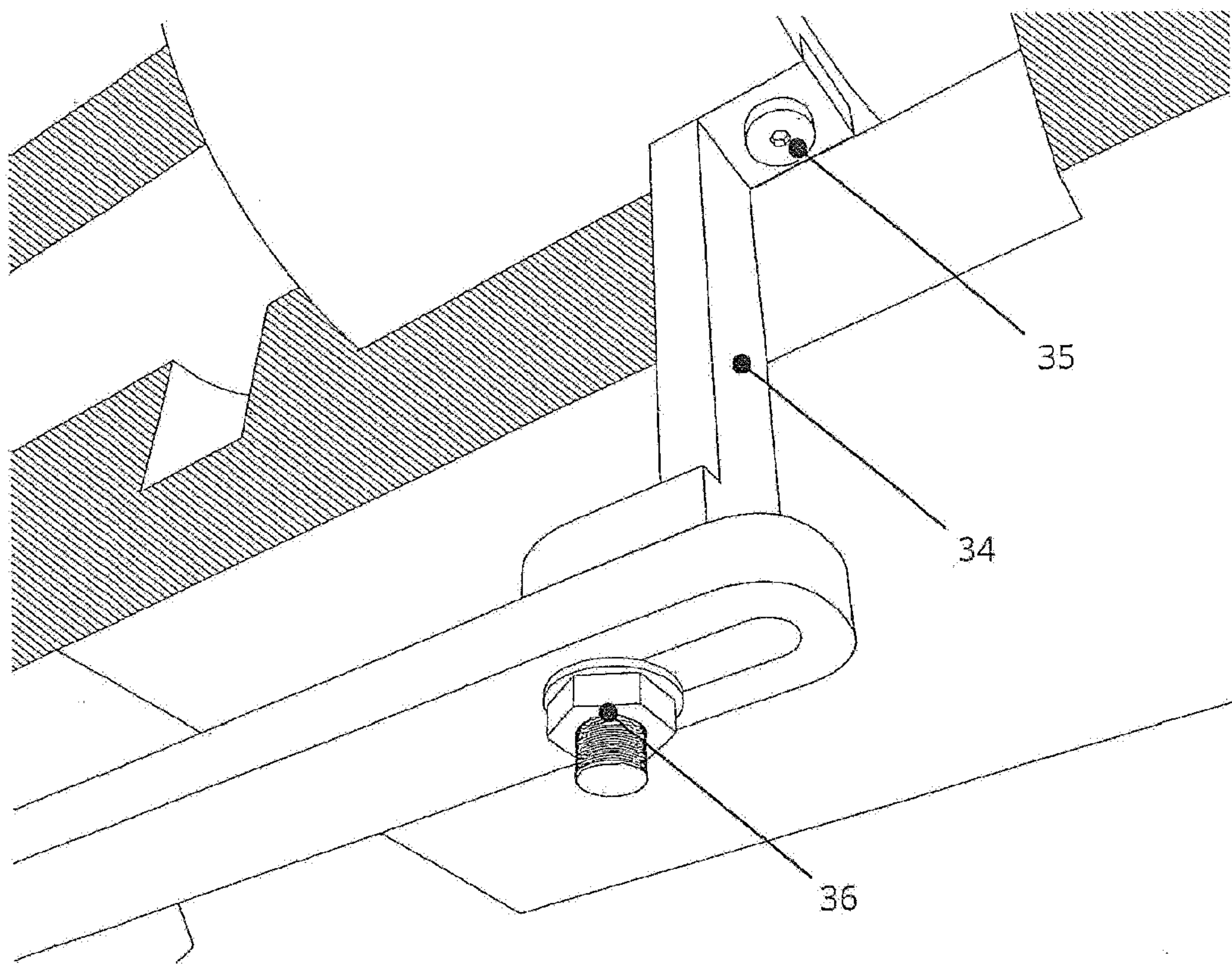


Fig. 7

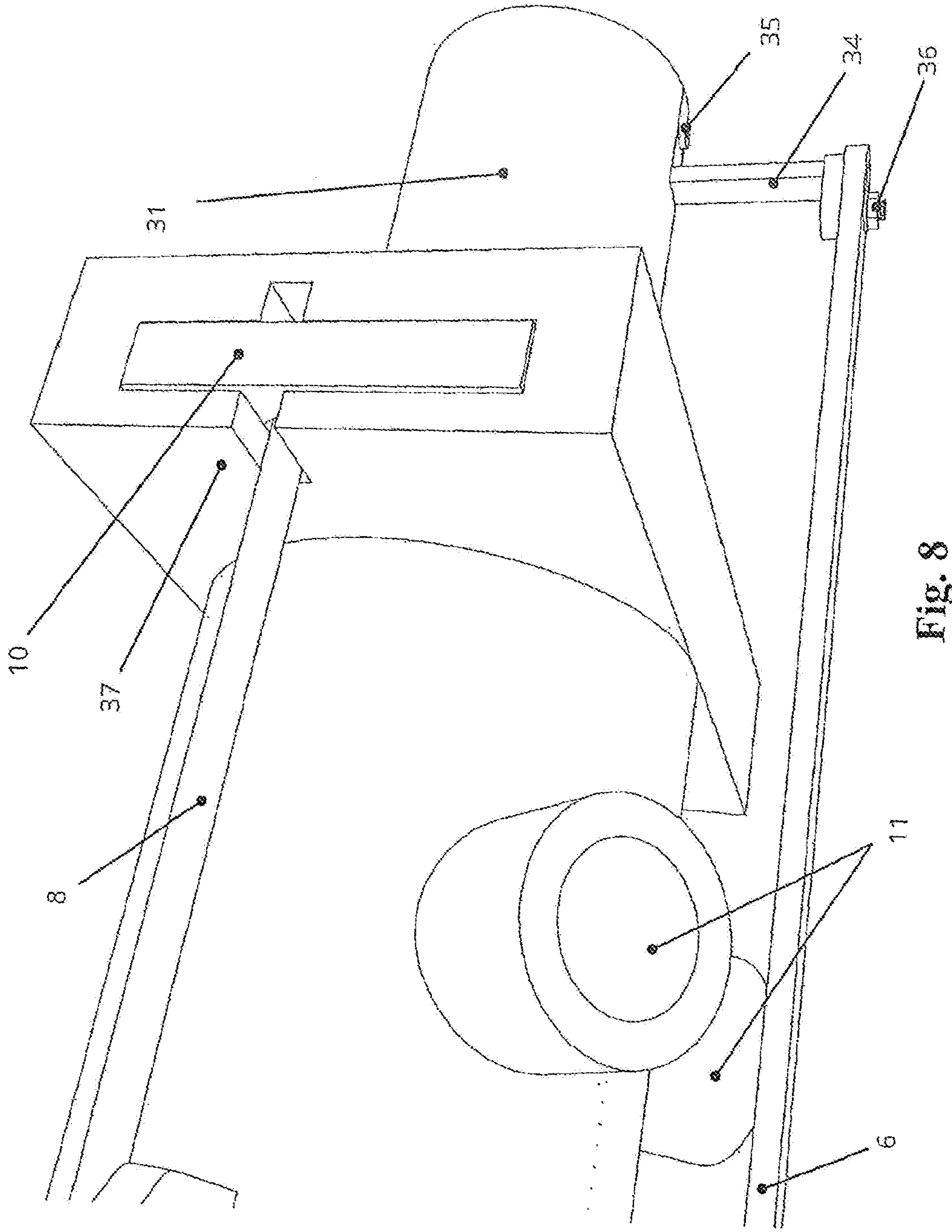


Fig. 8

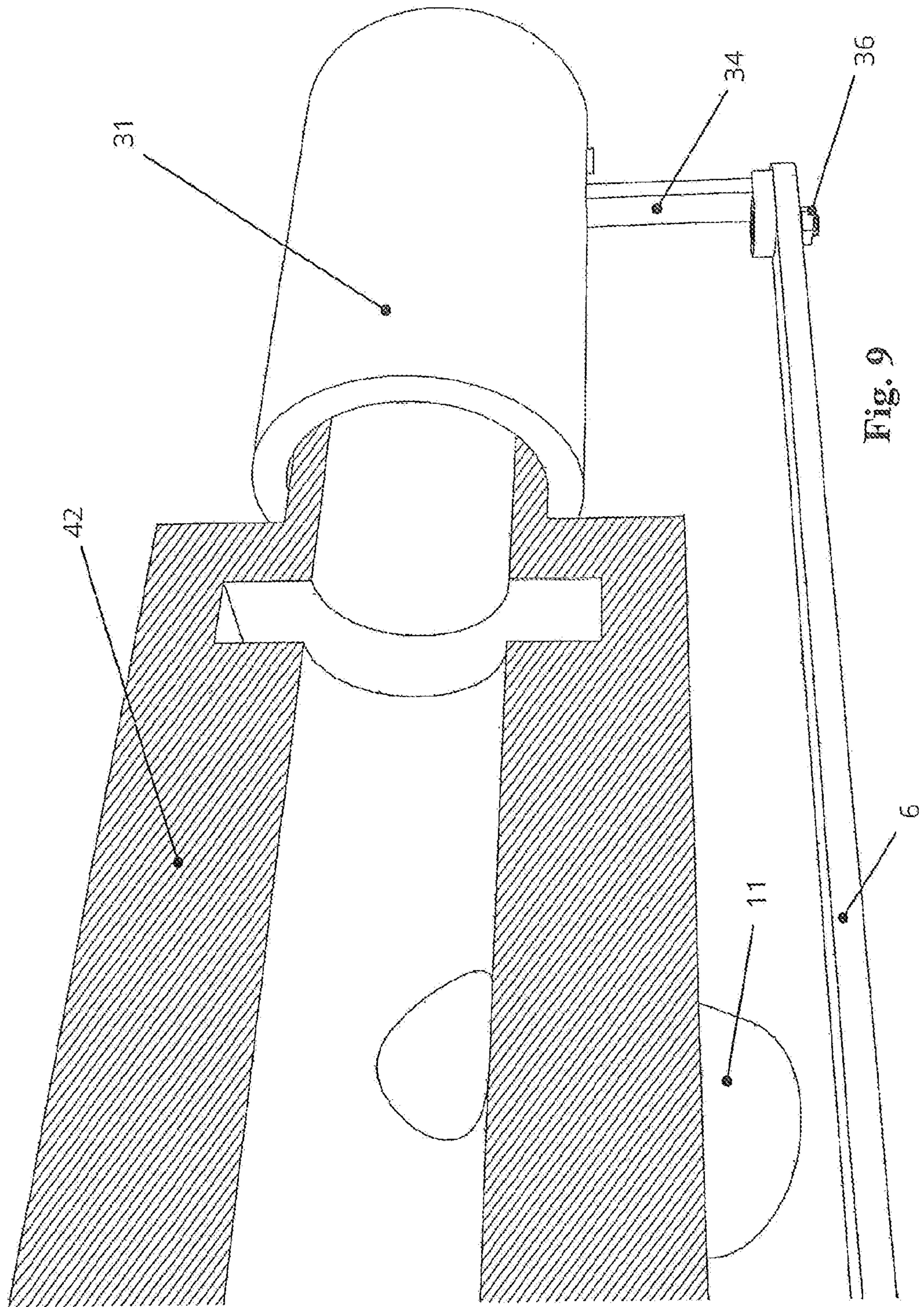


Fig. 9

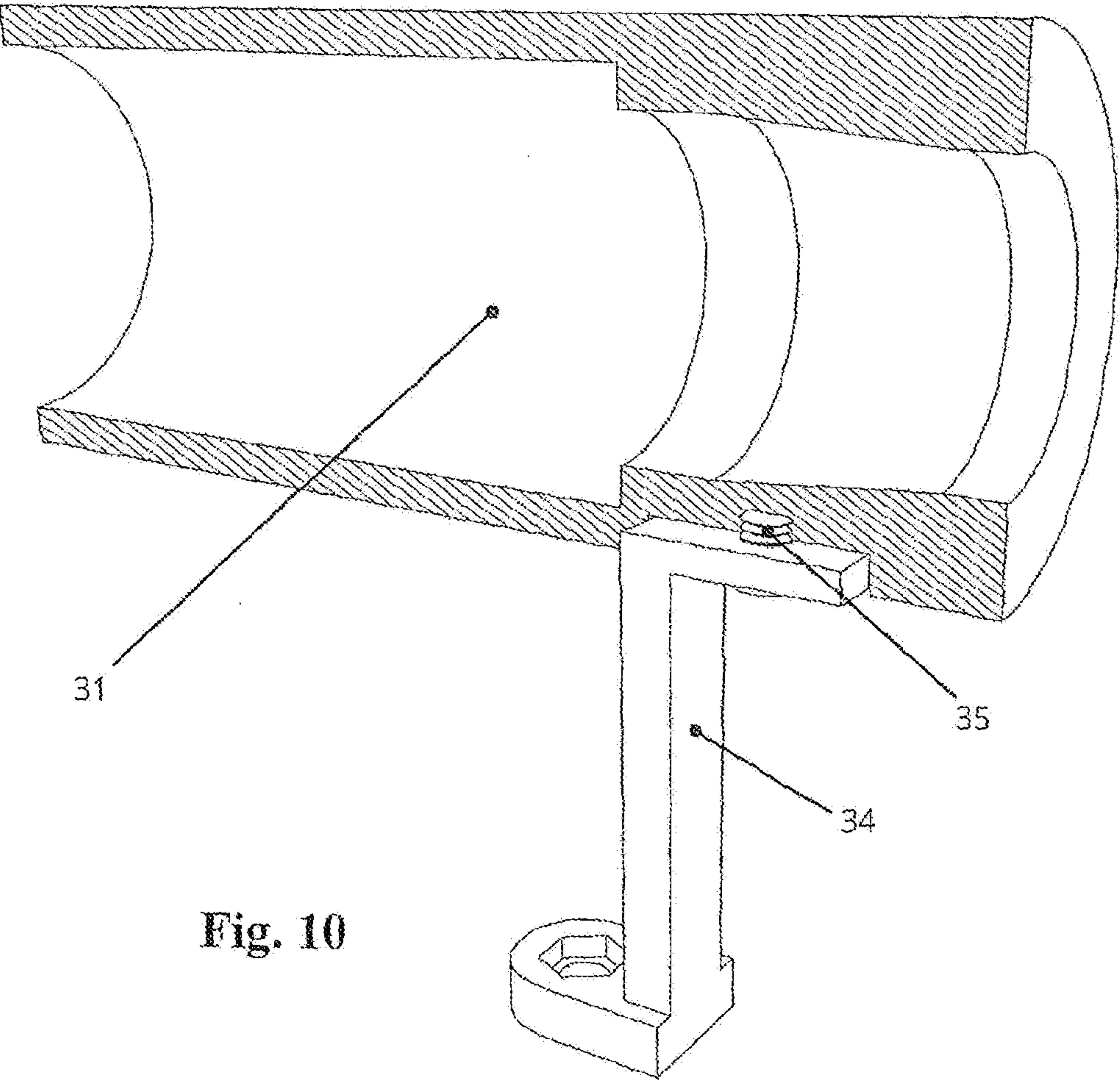
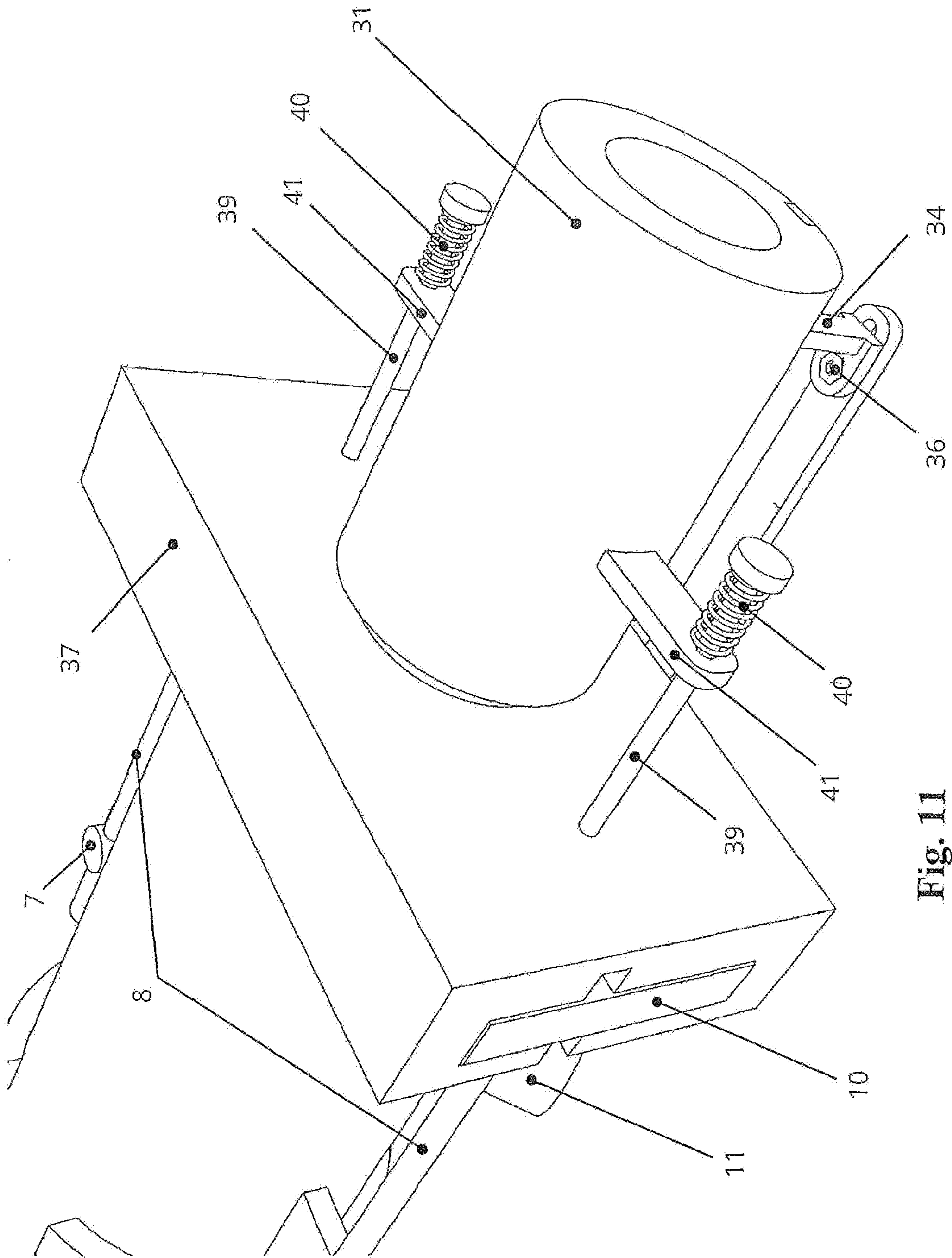


Fig. 10



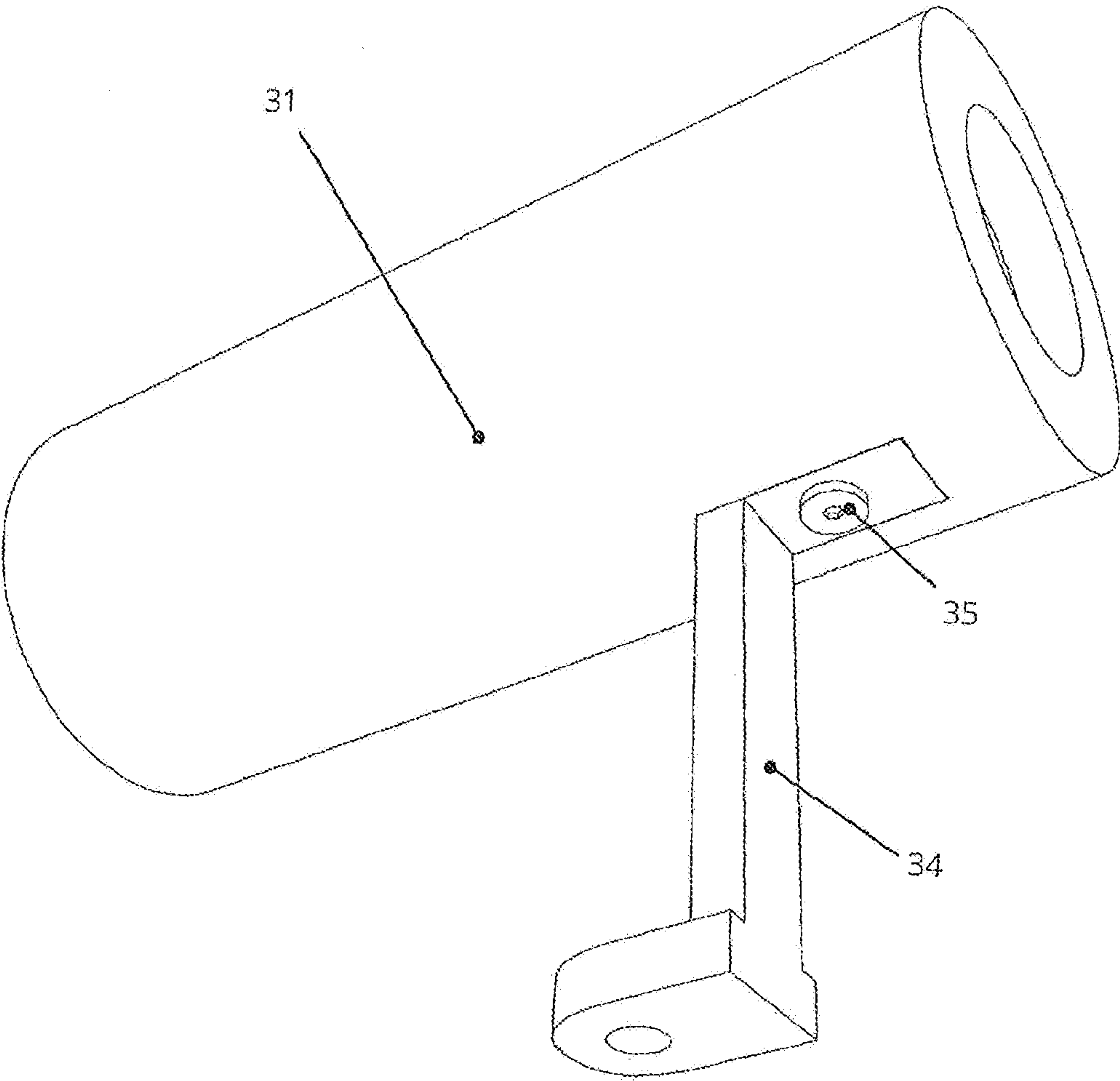


Fig. 12

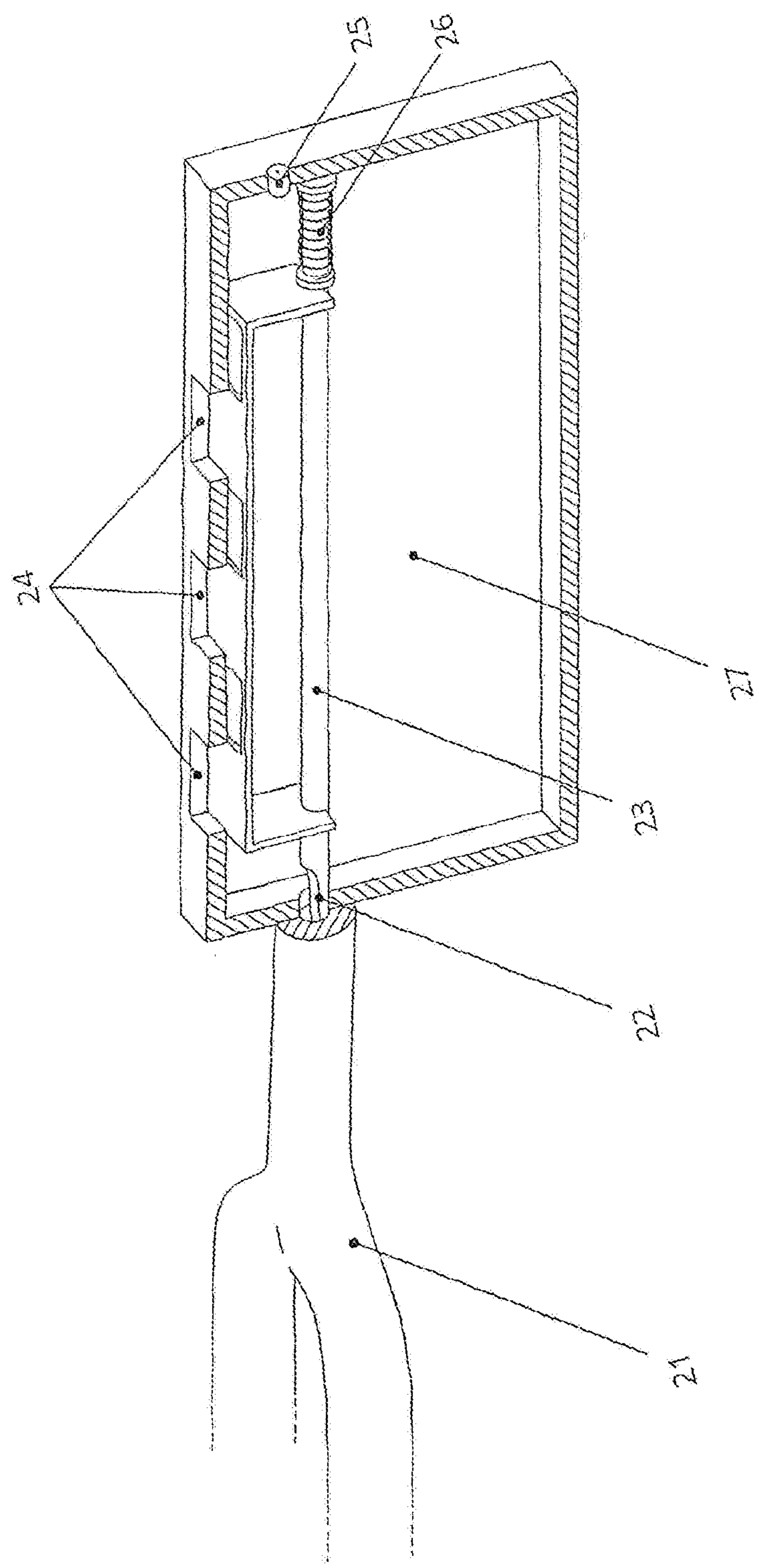


Fig. 13