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(54) **A device for projectiles.**

(57) A device for projectiles for translating an axial movement of a transmission element (11) in the firing direction (P) of the projectile into a rotary movement for the actuation of means (2, 28, 35) for initiating or arming the priming system of the projectile. The transmission element is provided with at least one helicoidal portion (12) engaging, during said axial movement of the transmission element, with a guide means (18, 19) which urges the transmission element into performing said rotary movement.

EP 0 433 259 A1

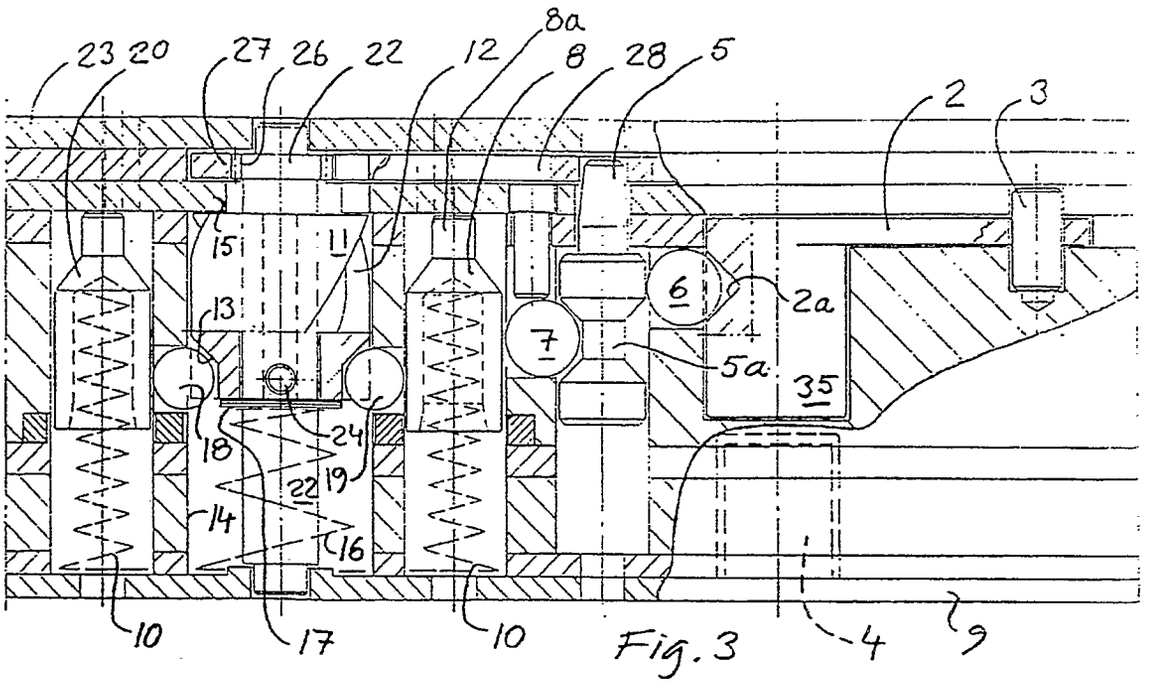
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Fig. 3

Technical field

The present invention relates to a device for projectiles for translating an axial movement of a transmission element in the direction of firing of the projectile into a rotary movement for the actuation of means for initiating or arming the priming system of the projectile.

In the case where the device according to the invention is used for arming of the priming system of a projectile it fulfills a need as a standard safety device for projectiles, which do not rotate or which rotate at a relatively low speed, such as mortar, tank and artillery ammunition, missiles, and bombs.

In the case where the device according to the invention is used for initiation of the priming system of a projectile, it is part of, for example, a system for delayed closing of an electric circuit in a priming system for direct initiation of a secondary explosive, such as EFI or laser priming devices.

Prior art

It is known in priming systems for projectiles to translate movements of a certain orientation and size into movements of other orientation and size in order to achieve various functions. Examples of such devices will be found in the Swedish lay-open print 431 124 concerning a detonator safety device for rotating projectiles.

If the projectile does not rotate, no rotation force can be used, and in order to achieve the various functions one therefore has to rely entirely on axial forces, which restricts the design possibilities, complicates the movement transmission devices and/or makes them less reliable or more space-requiring.

Description of the invention

It is an object of the present invention to provide a device of the above-mentioned kind, which in a simple and reliable way achieves translation of the axial movement into a rotary movement, which takes up little space and may be integrated into existing priming systems without major design modifications.

This object is achieved by the device according to the invention being provided with the features stated in the characterizing portions of the claims.

Description of the figures

Figs. 1 and 2 are a side view and a plan view respectively of a detonator safety device including the device according to the invention,

Figs. 3 and 4 are both side views partly in section along the line A-A of Fig. 2, Fig. 3 showing the device according to the invention in a safety position, and Fig. 4 showing the device according to the invention in an armed position,

Figs. 5 and 6 are both views along the line B-B of Fig. 1, however, essentially only movable elements are included, Fig. 5 showing the device according to the invention in a safety position and Fig. 6 showing the device according to the invention in an armed position, and

Figs. 7 and 8 are both side views partly in section along the line C-C of Fig. 2, Fig. 7 showing the device according to the invention in a safety position and Fig. 8 showing the device according to the invention in an armed position.

Preferred embodiments

Only one of possible embodiments of the present invention is shown in the drawings, i.e. the one relating to the use of the device according to the invention in a time delayed safety mechanism in a detonator safety device for non-rotating or slowly rotating projectiles such as mortar ammunition, anti-submarine grenades, mines, missiles and bombs.

Projectile rotation is thus not used as energy source for achieving the operation of the safety mechanism but instead in the embodiment shown said operation is achieved by using the acceleration of the projectile.

The rotary movement achieved by the device according to the invention, which movement has been translated from a rectilinear acceleration movement, is slowed down by a retarding device comprising a gear wheel and an armature means for achieving a time delay of an arming process. The time delay is the ultimate guarantee for the safety in handling and firing of ammunition up to a point of time during the trajectory of the projectile when arming of the priming system can take place without endangering the person carrying out the firing.

An essential condition for the safety level of the detonator safety device is that the force urging the system into arming must not have been stored before the time of use, which condition is fulfilled by the disclosed device.

A detonator safety device comprising the device according to the invention consist of a substantially circular-cylindrical body 1 made up of several disc-shaped units, which body is mounted in the known way between a fuze and a booster charge in the front part of a projectile, such as a grenade, intended to be fired in the direction of the arrow P of Fig. 1 through the muzzle of a barrel of a weapon. The body 1 encloses all of the details for maintaining the device in a safety position and for preventing said booster charge from being initiated by the fuze and for arming the device and for permitting initiation of the booster charge by means of a flame ejected from the fuze or by means of a pin projecting from the fuze.

Figs. 3-7 illustrate a rotor 2 which is turnably

mounted about a shaft 3, which rotor has to be turned from the position shown in Figs 3 5 and 7 to the position shown in Fig. 4, 6 and 8 in order for a lead charge 4 centrally disposed in the body 1 to detonate and actuate said booster charge in the projectile. The rotor 2 is prevented from turning and is thus held in a safety position by a detension pin 5 which is axially movable between the upper position shown in Fig. 3, wherein it is prevented from being axially displaced, and the position shown in Fig 4, wherein it does not prevent turning of the rotor 2 owing to a retaining means in the form of, for example, a ball 6 having been moved out of engagement with a recess 2a on the periphery of the rotor. The ball 6 is displaced out of said engagement after the detension pin 5, optionally against the action of a low spring force, has been released for downward movement of a retaining means in the form of, for example, a ball 7. In the safety position of the device, the ball is partly located in a ringshaped recess 5a of the detension pin 5 and cannot be displaced out of same owing to a retaining means in the form of a setback pin 8 preventing this. When, however, the setback pin 8, by the action of the acceleration of the projectile, is displaced downwardly from the position shown in Fig. 3, so that an upper portion 8a of the setback pin 8, which upper portion has a smaller diameter than the rest of the setback pin, will be located opposite the ball 7, the ball 7 will be displaceable towards the portion 8a of the chamfered part of the detension pin 5 located between the recess 5a and an upper thickened portion of the detension pin, when the detension pin 5, by the action of the acceleration, is displaced downwardly from the position of Fig. 3 to the position of Fig. 4. When the detension pin 5 has taken its lower position of Fig. 4, wherein it will remain, and acceleration has stopped or decreased, the setback pin 8 will return from its lower position shown in dotted lines to the upper position shown in Figs. 3 and 4 in continuous lines owing to a compression spring 10 inserted between the setback pin 8 and a base plate 9 on the body 1.

When the rotor 2 is no longer prevented by the ball 6 from turning about the shaft 3, the rotor 2 cannot turn anyway owing to vet another condition having to be fulfilled. Said condition is that yet another retaining device has to be released, which retaining device is also acceleration dependent and which comprise*s the below described device according to the invention.

Said device comprises, as its most essential portion, a transmission element 11 in the form of a hollow circular cylinder with two helicoidal grooves 12 round its periphery and two diametrically opposed, essentially semispherical recesses 13 at the lower part 13 of the element 11.

The transmission element 11 is axially displaceable and rotatably mounted in a cylindrical space 14 in the body 1. In this position the working surfaces of the element 11 are protected against knocks, bumps and other impact during transport, storage and handling of the device. In its upper safe position as shown in Fig. 3, the element 11 is pressed against a fixed portion 15 of the body 1 by a helical compression spring 16 which is cone-shaped so as to make it possible for adjacent helical turns to be inserted into each other when the spring is compressed and the spring therefore is to take up little axial space. The spring 16 bears against the base plate 9 as well as against friction reducing means 17, comprising, for example, a metal plate bearing against the spring 16, and a Teflon plate disposed between the metal plate and the lower portion of the element 11.

In the upper position of the transmission element 11 as shown in Fig. 3 two retaining means in the form of balls 18 and 19 are partly inserted in the recesses 13. The balls 18 and 19 are axially held in position by recesses in the walls of the space 14 and radially outwards by the setback pin 8 and a setback pin 20 identical with and acting in the same way as the setback pin 8.

When the transmission element 11 is subject to a downward force according to Fig. 3, caused by the acceleration of the projectile in the direction of the arrow P, the setback pins 8 and 20 are also subject to a downward force, and both the element 11 and the setback pins 8, 20 are brought at about the same time to their lower positions shown in Fig. 4 in continuous lines for the element 11 and in dotted lines for the setback pins 8, 20. The axial downward movement of the setback pins 8, 20 is a controlled condition for the axial movement of the element 11 to the same position. The controlled condition is that the balls 18, 19 are prevented by the setback pins 8, 20 from leaving their positions in the recesses 13. Owing to the time constant for the mass of the transmission device 11 and the force of the spring 16 being considerably longer than for the mass of the setback pins 8 and 20 and the forces of the springs 10, when the acceleration of the projectile is reduced or ceases, the setback pins will return from the position of Fig. 4 to the position of Fig. 3 earlier than the element 11.

In the axial aperture of the transmission element 11 there is inserted a shaft 22. The shaft 22 is turnably mounted in the base plate 9 and in a top plate 23. The spring 16 and the plates 17 surround the shaft 22. A pin 24 is mounted in a radial aperture in the shaft 22, one end 24a (Fig. 7) of the pin projecting over a distance from the mantle surface of the shaft 22. The pin end 24a engages with an axial groove 25 in the axial aperture of the element 11. The upper portion of the shaft 22 is provided with a gear 26 meshing with a gear 27 on a gear segment 28 (Figs. 3, 5-8). The gear segment 28 is provided with a gear path 29, whith through a gear wheel 30 operates an armature 31 of a conventional retarding device. The armature 31 is provided with an oscillating movement by the gear

wheel 30 about a shaft 32, whereby the counter clockwise turning of the segment 28 about the shaft 22 is delayed (slowed down) during a predetermined amount of time.

The gear segment 28 is provided with an open recess 33 and an oblong hole 34. The recess 33 is movable from a safe position (Fig. 5), in which it is spaced from the centre hole in the body 1, to which the detonator 35 mounted in the rotor 2 may be brought, to an armed poisition (Fig. 6) in which the recess is opposite the centre hole. The hole 34 surrounds a follower pin 36 mounted on the rotor 2.

Upon firing and acceleration of the projectile provided with the device according to the invention and after the transmission element 11, against the action of the spring 16, has been brought to its lower position (Fig. 4) — which was made possible by the balls 18 and 19 being pressed radially outwards by the chamfered upper edges of the recesses 13 when the setback pins 8 and 20 had been brought to their positions as shown in dotted lines in Fig. 4 — acceleration will decrease so that the spring 16 will press the transmission element upwards. Immediately before, the setback pins 8 and 20 had been brought to their upper positions pressing the balls 18, 19 radially outwards. When the transmission element 11 is pressed upwards, the balls 18 and 19, which in the upper position of the element 11 are located in the upper areas of the helicoidal grooves 12, will act as guide means for the element 11 which will turn counterclockwise from the position of Fig. 5. The groove 12, the section of which is preferably rectangular, has such a steep gradient that the element 11 will turn with a considerable effect on the force achieved by the spring 16. The means 17 ensures that friction between the spring 16 and the element 11 will be low.

During its upward movement the element 11, through its axial groove 25 and the pin end 24a engaging with the groove, urges the shaft 22 in a counterclockwise direction, whereby the gear segment 28 is turned from the position of Fig. 5 to the position of Fig. 6 with the time delay provided by the retarding device 30-31.

On completion of the counterclockwise turning of the gear segment 28, the rotor 2 has been displaced by the follower pin 36 to the position shown in Fig. 6, in which the recess 33 exposes the centre hole to which the detonator 35 has been brought by the rotor.

According to another possible embodiment, a transmission element corresponding to the element 11 may be used for translating a rectilinear axial movement, caused, for example, by the acceleration of a projectile, into a rotary movement for closing or opening an electric circuit in a priming system for direct initiation of a secondary explosive or for achieving an adjustable time function for restricting the rotary movement so that the required amount of time will be provided, such as for use in connection with preset burst, in so called clockwork fuzes.

Although only one embodiment of the present invention has been described above and illustrated in the drawings, and only a further few embodiments have been briefly described above, it will be understood that the invention is not limited to said embodiments but only by what is stated in the claims.

Claims

1. A device for projectiles for providing, during the firing of a projectile, a rotary movement for the actuation of means (2, 28, 35) for initiating or arming the priming system of the projectile, characterized by a transmission element (11) which is axially displaceable in the firing direction of the projectile and in the opposite direction thereto and which is provided with at least one helicoidal portion (12) engaging, during said axial movement of the transmission element in the direction of firing, with a guide means (18, 19) which urges the transmission element into performing said rotary movement.

2. A device according to claim 1, characterized in that the helicoidal portion comprises grooves (12) and the guide means comprises at least one ball (18, 19) disposed therein.

3. A device according to claim 1 or 2, characterized in that the transmission element (11) is spring-biased (16) in the firing direction of the projectile.

4. A device according to claim 3, characterized by a helical spring (16) one end of which bears against the transmission element (11) through friction reducing means (17).

5. A device according to claim 4, characterized in that the helical spring (16) is cone-shaped, so that its winding turns are partly inserted in each other when the helical spring is compressed.

6. A device according to any of the preceding claims, characterized in that the transmission element (11) before firing is held in its position in the direction of firing by a retaining means (8, 20) preferably acting on the guide means (18, 19).

7. A Device according to any of the preceding claims, characterized in that the guide means (18, 19) is displaceable out of engagement with the helicoidal portion (12) of the transmission element (11) for permitting the axial movement of the transmission element in the opposite direction to the firing direction without the transmission element being turned.

8. A device according to any of the preceding claims, characterized in that the transmission element (11) is axially displaceable on a shaft (22), that the transmission element and the shaft are provided with means (24, 25) engaging with each other and permitting axial movement of the transmission element on the shaft during simultaneous turning of said means, and that the shaft is connected to the means (2, 28, 35) for initiating or arming the priming system of the projectile.

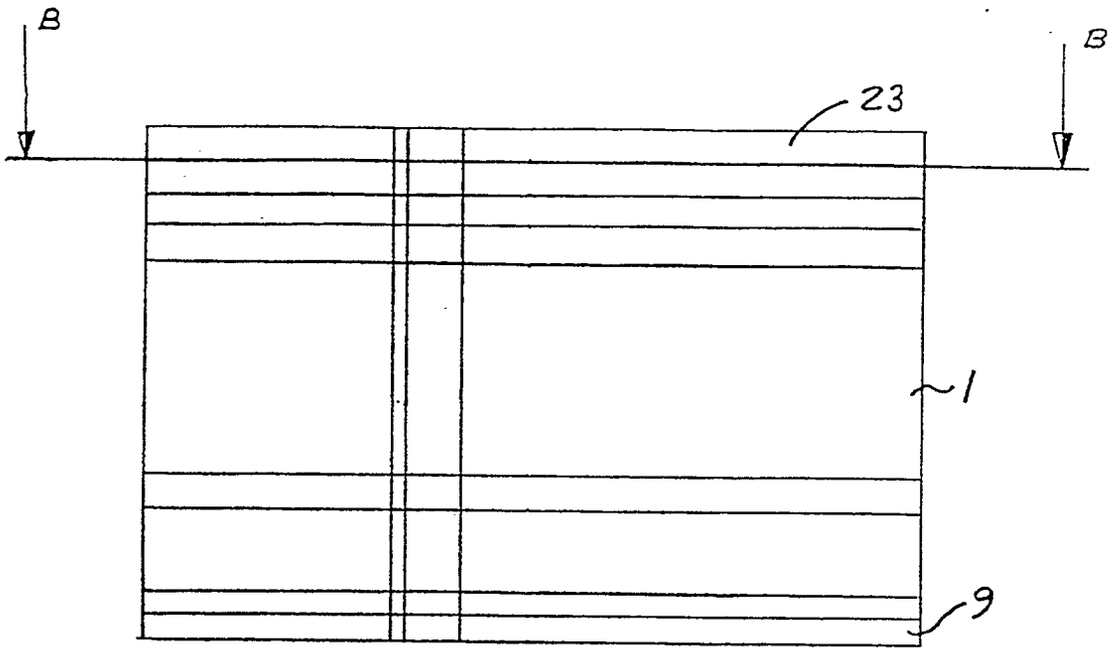

Fig. 1

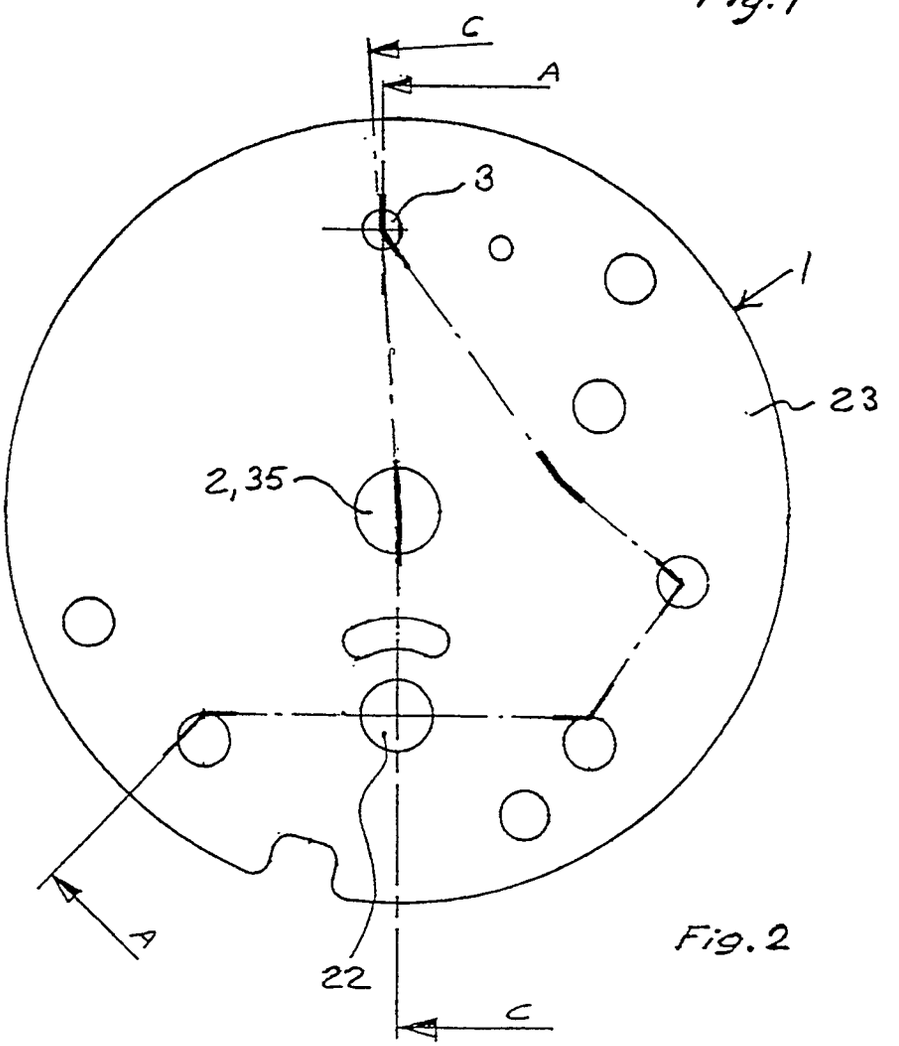

Fig. 2

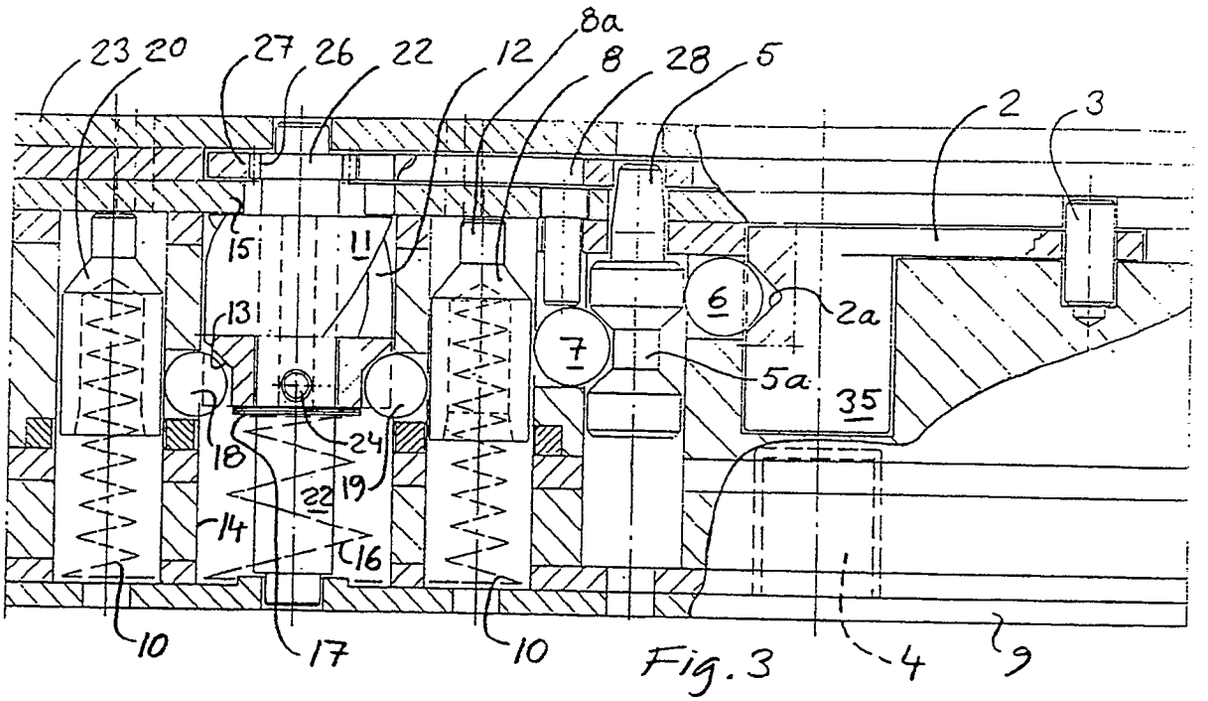
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Fig. 3

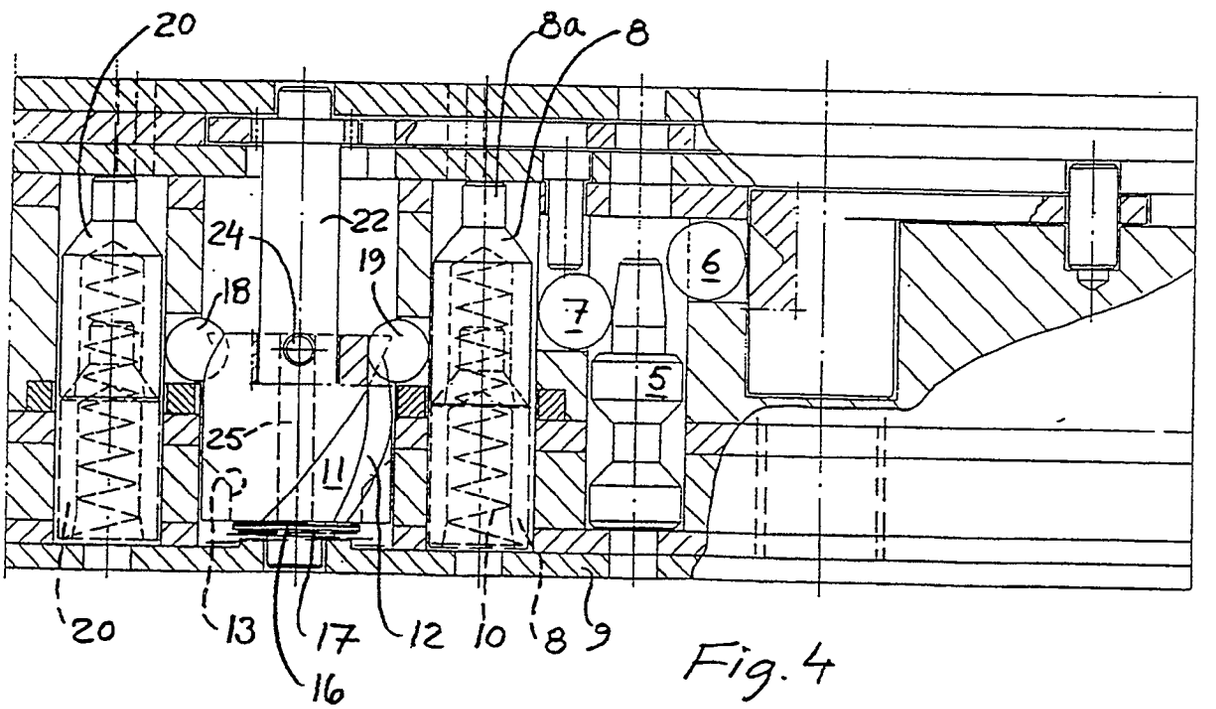
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Fig. 4

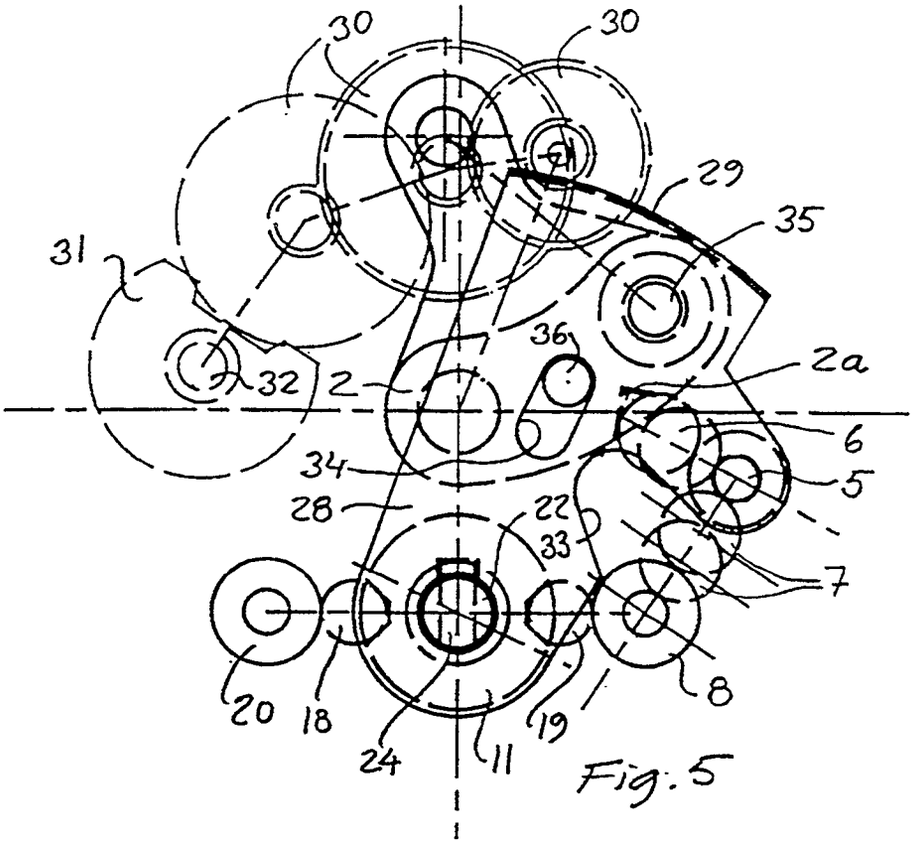
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Fig. 5

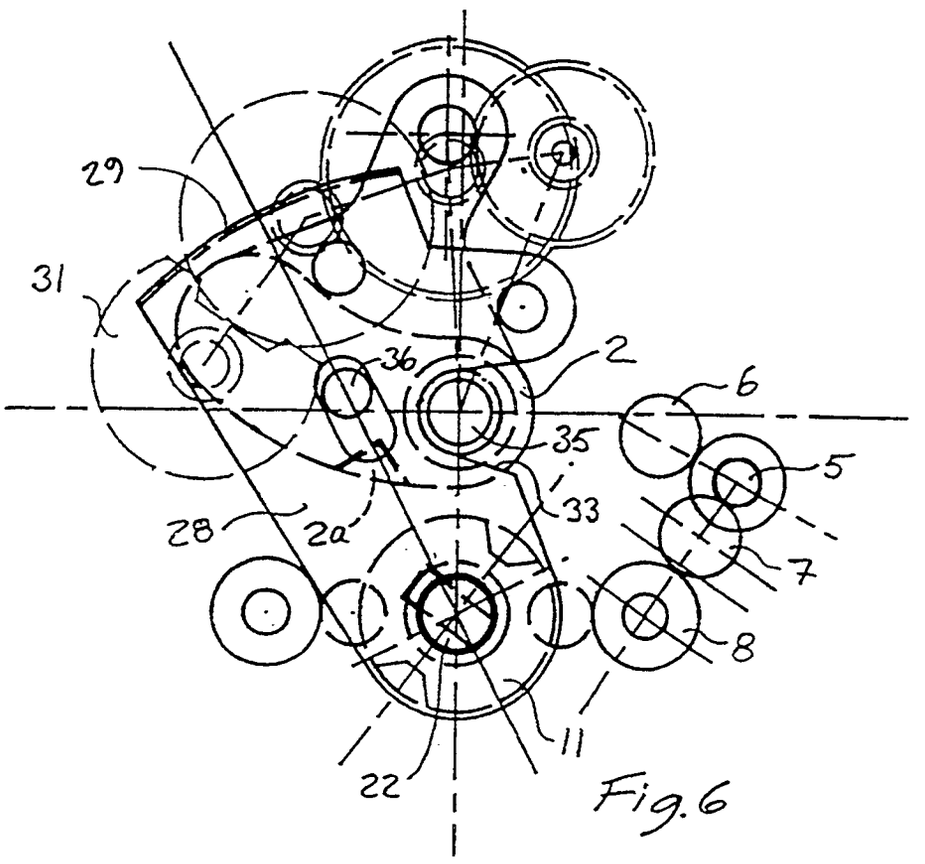
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Fig. 6

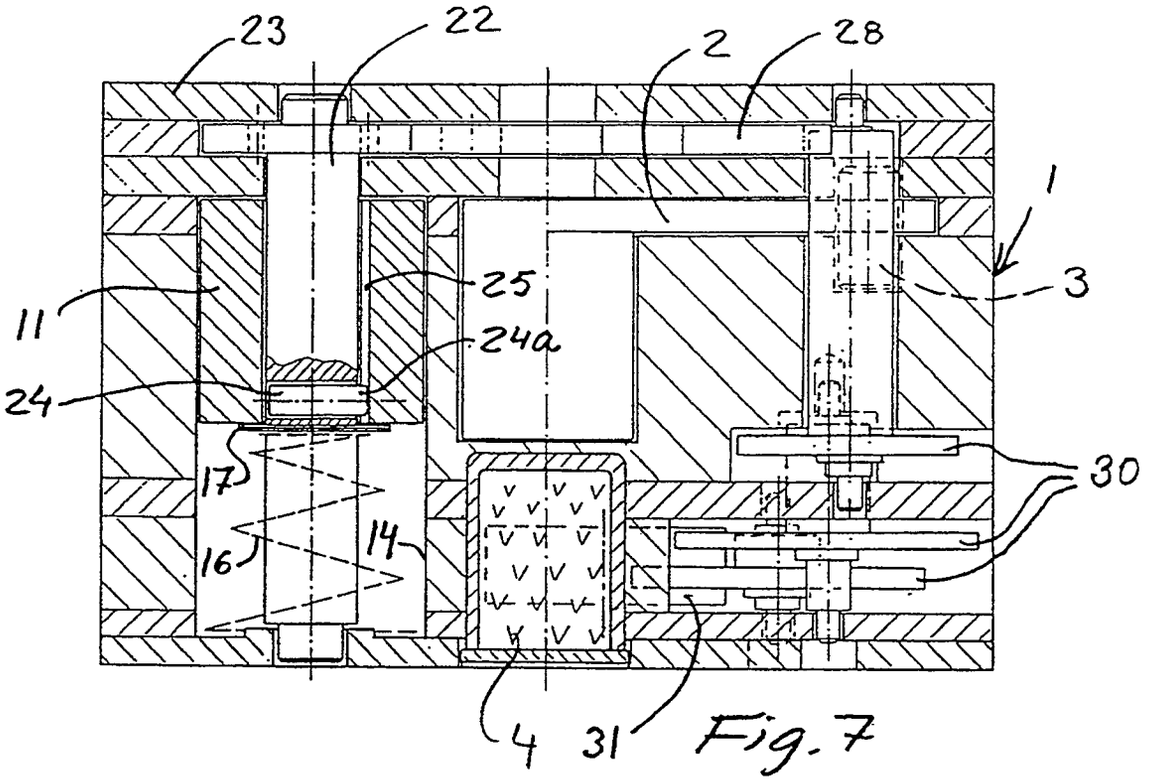

Fig. 7

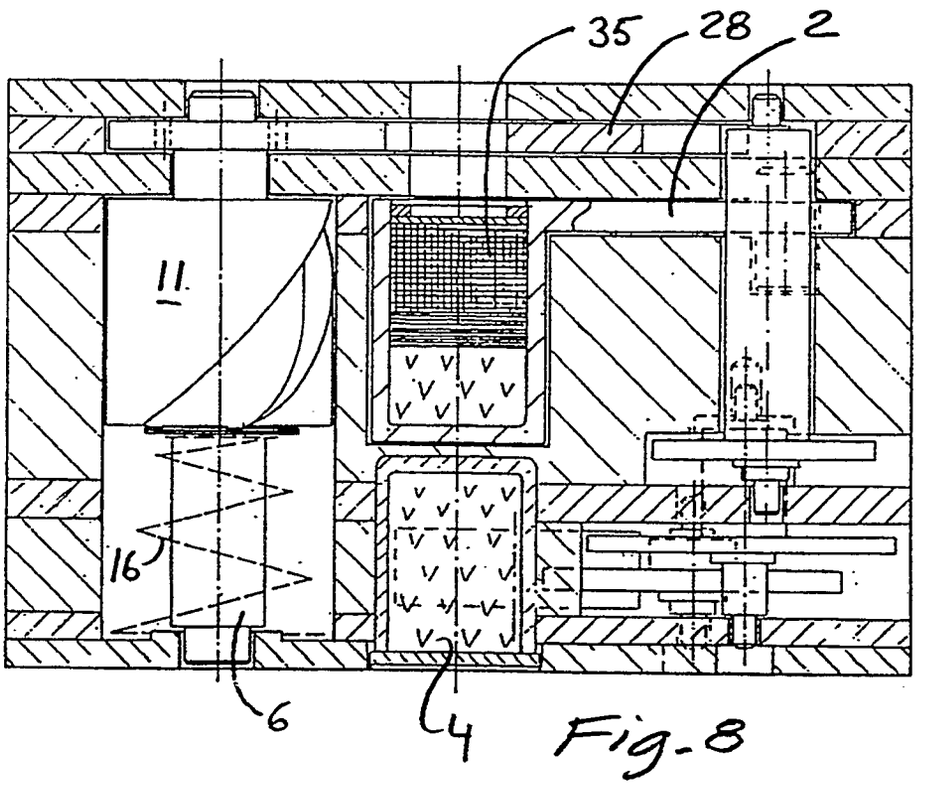

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number

EP 90 85 0406

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-672590 (ENERGA) * page 2, lines 52 - 34; figures 1-8 *	1-4, 8	F42C15/24
A	DE-A-2643828 (GEBRUDER JUNGHANS) * page 9, last paragraph - page 11, paragraph 1; figures *	1	
A	US-A-2789507 (APOTHELOZ)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F42C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 MARCH 1991	TRIANTAPHILLOU P.

CATEGORY OF CITED DOCUMENTS

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